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Journal

of the

Royal Army Medical Corps

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Journal

OF THE

Royal Army Medical Corps

EDITED BY

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VOL. LIV.

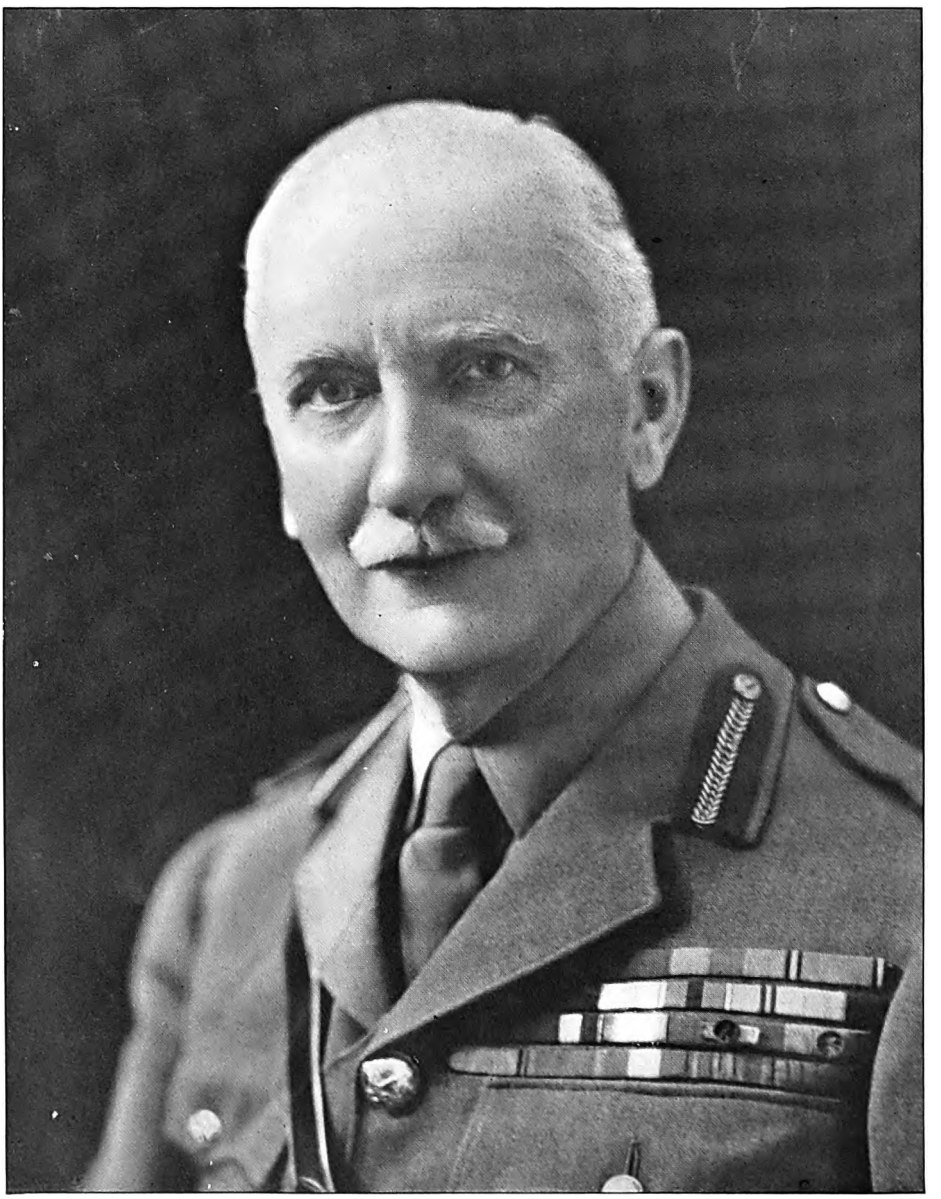
January—June, 1930.

JOHN BALE, SONS & DANIELSSON, LTD.
83-91, GREAT TITCHFIELD STREET, OXFORD STREET, W. 1.

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LIEUTENANT-GENERAL SIR ARTHUR SLOGGETT,
K.C.B., K.C.M.G., K.C.V.O.

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VOL. LIV. JANUARY, 1930. No. 1.

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Journal of the Royal Army Medical Corps.

3-30-34 £/3

Obituary.

LIEUTENANT-GENERAL SIR ARTHUR SLOGGETT, K.C.B., K.C.M.G., K.C.V.O.

SIR ARTHUR SLOGGETT was the son of Inspector-General W. H. Sloggett, R.N., and was born at Stoke Damerel, Devon, on November 24, 1857. He was educated at King's College, London, of which he was subsequently elected a Fellow. He obtained the M.R.C.S.England and L.R.C.P.Edinburgh in 1880, and on February 5, 1881, was commissioned as Surgeon in the Medical Staff. In his batch were several men who afterwards attained distinction as administrators, the most eminent among them being the late Sir William Babtie. Sir Arthur Sloggett will be chiefly remembered as a wise administrator, his *savoir-faire*, knowledge of the world and of men, enabled him to succeed where other men, though well versed in Regulations, would have failed.

Sir Arthur saw much active service and was senior medical officer with British troops in the Dongola expedition, 1896; he was mentioned in dispatches, received the Egyptian medal with two clasps, the Order of the Osmanieh and was promoted Surgeon Lieutenant-Colonel.

He was senior medical officer of the First Brigade of the British Division of the Nile expedition in 1898, and was dangerously wounded, being shot through the chest at the Battle of Khartoum. For his services he was mentioned in dispatches, was granted the higher rate of pay as Lieutenant-Colonel, and received the order of the Medjidieh (3rd class).

In the South African War he had the local rank of Colonel and was in charge of the Imperial Yeomanry Hospital, then P.M.O. of a General Hospital and Commandant Deelfontein District. He took part in the operations in the Orange Free State in April and May, and in the Transvaal in June and July, 1900, and in operations in the Transvaal, Orange Free

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State, and Cape Colony down to 1902. He was mentioned in dispatches, and received the two medals with five clasps and the C.M.G. In 1903 he was promoted to the rank of Colonel, and was appointed P.M.O. of the London District, where he remained until 1908. Those who served with him in those days could not help noticing how smoothly everything went in the district; there was no fuss or worry. Sir Arthur knew most people of note and his personal qualities had much to do with his successful administration.

In July, 1908, he was appointed P.M.O. of the 6th Division in India with headquarters at Poona, and remained in this command until December, 1911, when he was selected for the appointment of P.M.O. of the British Forces, India. He remained at Headquarters as Director of Medical Services until 1914. In this appointment he always had the advancement of the work of the Corps at heart and was unfailing in his efforts to promote contentment among those serving under him. He was instrumental in bringing together in India some of the best athletic teams which the Corps produced. He was promoted Surgeon General in 1908, and received the C.B. Military in 1910. In 1911 he was appointed Honorary Surgeon to the King. In June, 1914, he was called home to succeed Sir Launcelotte Gubbins as Director-General Army Medical Services.

When war broke out in August, 1914, Sir Arthur Sloggett remained at the War Office for the first few weeks, when he had to deal with the many problems associated with mobilization of the divisions of the Expeditionary Force, the formation of camps for new divisions which were rapidly being formed, and the work of the Red Cross. In this he was ably assisted by the late Sir William Macpherson, who at that time was Deputy Director-General at the War Office.

Unfortunately, just at this time, Sir Arthur fell ill, and after a short interregnum, during which Sir William Macpherson carried on the duties of D.D.G. and D.G., Sir Alfred Keogh was called to the War Office to act as D.G. When Sir Arthur Sloggett had recovered he went to France and Sir Alfred Keogh remained at the War Office.

After the first battle of Ypres, when the German push for the Channel ports had been arrested, and affairs at the Front in France had become temporarily stabilized, Lord Kitchener formed the opinion that the war was likely to last for two or three years instead of the few weeks suggested by the General Staff, and that it would be necessary to raise new armies. In these circumstances it was thought desirable to have a Director-General in France of great experience in war, and Sir Arthur Sloggett was appointed Director-General of Medical Services of the British Armies, and Chief Commissioner of the Red Cross and the Order of St. John of Jerusalem.

In both capacities he served with great distinction until June, 1918, when his term of office in the ordinary course ended. His business capacities, experience of war, and geniality found full scope in dealing with the Regular, Territorial, Voluntary and Red Cross medical units, and with the Consultants, who were men of great distinction in civil life but had

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little knowledge of Service methods and requirements when they first joined the various armies, the L. of C. and the bases. Where there might have been great friction everything worked smoothly under Sir Arthur's guidance. He had an unusual capacity of drawing men together and making them work harmoniously. His powers as a peacemaker were feelingly referred to by the late Earl Haig in his speech at the dinner given to the Medical Service after the war. Sir Arthur had an open mind and was always willing to take advice from those he considered competent to give it. His wide outlook enabled him to meet all difficulties with tact and tolerance and a minimum of red tape.

A medical organization gradually came into being which was considered a model for the then existing conditions. The arrangements for the early treatment of the severely wounded, and more especially for the treatment of cranial and abdominal wounds, fractures and burns, were made possible by the facilities given to the D.M.S. of each army and the consulting surgeons. An effective liaison was also developed between the British and Allied Medical Services which was of value in creating mutual respect and friendship.

When the final war of movement arrived the direction of medical affairs had passed into other hands; but there is no doubt that the arrangements already made by Sir Arthur Sloggett had a great influence on the ultimate result.

Sir Arthur's shrewd judgment and knowledge of men aided him in the selection of his personal staff. He treated them as friends, and no man was better served. His staff loved him; they knew that behind all his actions there was a genuinely kind heart and perfect loyalty to them. His gay vitality was infectious and created an atmosphere of happiness for his immediate entourage in France. If a disagreeable thing had to be done, it was accomplished in such a kindly way that no bitter feeling was left in the mind of the sufferer.

His exuberance of spirit might occasionally lead him into indiscretions, for he was very human, but they counted as nothing compared with the efficient control which he maintained mainly through his personal influence over all those who were in charge of the various organizations for the relief of human suffering.

His delightful hospitality will always be remembered by those who had occasion to visit his headquarters, where they were treated to the best he had to give.

Sir Arthur Sloggett had most happy relations with the three successive Commissioners of the Red Cross, Sir Courtauld Thomson, Lord Donoughmore, and Sir Arthur Lawley. When he left G.H.Q. he wrote to Sir Arthur Stanley, Chairman of the Joint War Committee of the British Red Cross and the Order of St. John, a letter in which he said the officers, nursing sisters, and other ranks employed by the Committee had earned the respect of all branches of the Service, and the heroism of drivers—male

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and female—of the motor-ambulance convoys had been the admiration of everyone in France.

Sir Arthur Sloggett was knighted in 1914, and in 1915 was created K.C.B. and made a Grand Officer of the Legion of Honour (2nd class). In 1916 he was made a Commander of the Order of Leopold (1st class), and in 1917 was created K.C.M.G. and K.C.V.O., and was made a Fellow of the Royal College of Surgeons.

He was a Colonel Commandant of the Royal Army Medical Corps from 1921 to 1928.

After he retired from the active list Sir Arthur still took a great interest in the doings of the Corps, he frequently dined at the Headquarter Mess, and was always present at the Annual Dinner of the Corps. In 1927 he deputised for Sir Matthew Fell, then D.G., who was unable to be present through illness.

Sir Arthur's sudden death just when he had completed his 72nd year came as a great shock to his many friends. His genial presence will be much missed at all Corps functions.

The funeral service was held in the Chapel of Queen Alexandra Military Hospital, on December 2, and the Chaplain General officiated. The King was represented by Lieutenant-General H. B. Fawcus, Honorary Physician to His Majesty, and Director-General Army Medical Services; the Duke of Connaught by Major-General Blackwell, the Army Council by General Sir Walter Braithwaite, Adjutant-General to the Forces, and Sir Herbert Creedy, Permanent Under Secretary of State for War.

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Original Communications.

NOTE UPON THE PRODUCTION OF BRUCELLA AGGLUTININS.

By Major J. B. A. WIGMORE,
Royal Army Medical Corps.

A great deal of work has been published in the past few years upon the morphology, cultivation, serological reactions, etc., of the three races or species of the Brucella group, but unfortunately the authors are not always in agreement. Thus, Duncan states that in the case of *Br. abortus* the organism so closely approximates to the agglutinogenic structure of some strains of *Br. melitensis* that the unsupported evidence of the agglutinin absorption test cannot be accepted as a means of identifying it [1]. Carpenter, however, states that "It is necessary to employ the agglutinin absorption test to determine the specificity of the antibodies; *Br. melitensis* will remove some of the agglutinins from an anti-*abortus* serum and *Br. abortus* some of the agglutinins from an anti-*melitensis* serum, while each will remove all the agglutinins from its specific anti-serum" [2]. Ledoux says that heating the serum to 65° C. will remove all agglutinins both for *melitensis* and *abortus*; but Ficai states that the *abortus* agglutinins are more thermostable than those of *melitensis*.

The serum of Mrs. "R.," whose case has been described by Major F. C. K. Austin, Royal Army Medical Corps,[1] is interesting in that it supports the views of both Carpenter and Ficai. The serum was absorbed with

Table I.—Serum of Mrs. "R."

Organism	Absorbed with Oxford strain of *melitensis*				Absorbed with No. 5 strain of *abortus*			
	125	250	500	1250	125	250	500	1250
melitensis Oxford ..	–	–	–	–	–	–	–	–
abortus No. 5	+	S	S–	–	–	–	–	–

\+ indicates complete agglutination.
S indicates standard agglutination.
S– indicates incomplete agglutination.
– indicates absence of agglutination.

Br. melitensis (Oxford strain) and *Br. abortus* No. 5, i.e., the strain of *abortus* which gave the highest titre of agglutination. (See Table II.) Thirty thousand millions of each organism were mixed with one cubic centimetre of the serum diluted 1/10; then placed in a water bath at 65° C. for thirty minutes, and left at room temperature over night. In the morning the fluid was still hazy in the first tube, but the second, i.e., that to which *abortus* had been added, was quite clear, all the organisms having sunk to the bottom. On testing it was found that in the serum absorbed with *melitensis* only the *melitensis* agglutinins were completely

[1] This Journal, page 46.

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absorbed and the *abortus* agglutinins only slightly so ; whereas the serum absorbed with *abortus* showed that all agglutinins were removed. (See Table I.)

In recent years numerous observers, for example, Stuart in Palestine [3], Carpenter and Baker in North America, Beven in Rhodesia, and Ficai among many others in Italy, have published reports of series of cases of clinical undulant fever, where in the majority of cases the diagnosis rests upon the laboratory findings of the agglutination test, the causative organism being regarded as belonging to the *abortus* species of the group, though in an outbreak in Piedmont in Italy, during 1925, certain observers regarded the causative organism as a strain of *melitensis* [1]. The number of cases reported as arising in this country is at present small owing, I am inclined to think, to the difficulties in diagnosis. I believe one of these difficulties is the fact that a serum from a case of undulant fever, or more definitely from an artificially immunized rabbit, may fail to agglutinate all strains of either the homologous or heterologous species of the Brucella group. The practical result of this from the point of view of a worker in a laboratory may be twofold.

(*a*) A serum from a case of undulant fever may fail to agglutinate any of the three suspensions made from the available strains of *melitensis*, *paramelitensis* or *abortus* respectively.

(*b*) Should the infecting organism have been recovered either from the blood or urine of the patient, this in its turn may fail to be agglutinated by the antiserum of *melitensis*, *paramelitensis* or *abortus*.

In Britain, where the percentage of milk cows infected with *abortus* is high, it seems logical to assume that a fair number of people should become infected. As has been said, the number of diagnosed cases of undulant fever is very small, and it would appear that greater facilities for more accurate diagnosis are of importance. With this in view an investigation of all strains of the Brucella group in this laboratory was started in an attempt to find :—

(1) An anti-serum which would agglutinate all the strains of the group.

(2) Three anti-sera which would agglutinate all strains of *melitensis*, *paramelitensis* or *abortus* respectively.

(3) A strain from which a suspension could be made which would be agglutinated by all sera of Brucella-group infections.

(4) Three strains, i.e., *melitensis*, *paramelitensis* and *abortus*, of which suspensions could be made which would each be agglutinated by all antisera of their homologous species.

Of these (2) and (4) are obviously the more desirable, as (1) and (3) would merely indicate a Brucella infection without showing the species of the causative organism.

To do this, a number of rabbits were taken and inoculated with the following strains :—

(*a*) *Melitensis* Oxford (Caprini), *melitensis* W.P.R.L.8, *melitensis* Zammit, *melitensis* " D."

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(*b*) *Paramelitensis* Bassett-Smith, *paramelitensis* 2065, *paramelitensis* Ch. 83.

(*c*) *Abortus* No. 8 (Bang), *abortus* Swine, *abortus* Oxford (Bang).

The antigens used were 48-72 hour cultures of these strains grown in trypsin broth and killed by the addition of two drops of 40 per cent formalin to the test tube. Sterility was tested for on the following day.

Increasing doses of this dead culture, i.e., 0·2 cubic centimetre, 0·5 cubic centimetre, 0·75 cubic centimetre, and 1·0 cubic centimetre were injected into the ear veins of rabbits at intervals of five days. Blood was taken five days after the last injection.

The agglutinable cultures were prepared by repeatedly subculturing from broth after forty-eight hours' growth of the various strains, making twenty-one subcultures in all. They were then killed by the addition of forty per cent formalin, so that the final concentration was 0·2 per cent. They were adjusted as nearly as possible to the opacity of the standard agglutinable suspensions of *melitensis* and *abortus* issued by the Standard Laboratory of Oxford University, but owing to the feebleness of some of the growths, it was not always possible to obtain the desired opacity.

Matthews pointed out that as the turbidity of a bacterial suspension decreases, the agglutinability increases, there being a definite ratio between the amount of serum used and the number of organisms in the suspension when the full titre of the serum is reached. In his tests he showed that when the turbidity of the suspension was decreased by half, its agglutinability was doubled in sixty-five per cent of the positive results [4].

The Medical Research Council states "That in general terms the thinner the suspension within reasonable limits the higher is the titre obtained in the serum; and that the finer degrees of agglutination are best judged with a suspension of about 250-300 million organisms per cubic centimetre" [5].

In the tests carried out with the various cultures referred to above, I did not find that dilution increased their agglutinability after they were made to correspond as nearly as possible with the Oxford suspensions, and as I do not know the initial opacity of the suspension Matthews used, a comparison of results is not really possible.

A series of comparative agglutination tests was made with:—

(1) The sera of the ten rabbits referred to above.
(2) The Oxford standard agglutinating sera for *melitensis* and *abortus*.
(3) The sera from two human cases of Brucella infection, one of which was that of Mrs. "R." already referred to.

These were tested against the following cultures:—

(1) Six strains of *melitensis*.
(2) Three strains of *paramelitensis*.
(3) Seven strains of *abortus*.
(4) The Oxford standard agglutinable cultures of *melitensis* and *abortus*.

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The technique of agglutination used was that of Dreyer with incubation at 55° C. for four and a half hours.

Many observers, however, use longer periods, e.g., Carpenter read results after eight and again after twenty-four hours [2], and Matthews states that incubation for eighteen hours has given the most satisfactory results [4].

I did not use dilutions lower than 1/125, because of the great tendency of the Brucella group to show agglutination only in high rather than in low dilutions.

As controls, the cultures were put up against agglutinating sera of typhoid, Flexner, Shiga and normal rabbit's serum, and showed no agglutination which could be mistaken for a positive result.

Discussion.

From the results shown on Table II the following points appear clear :—

(1) The sera from human cases of infection show greater agglutinating powers than do the sera of rabbits immunized with killed cultures of the organisms.

(2) None of the immunized rabbits' sera were able to agglutinate in dilutions 1/125 or upwards :—

(*a*) All strains of *melitensis* (of the five anti-*melitensis* sera one, Zammit, only agglutinated three out of seven strains, and was unable to agglutinate its own homologous strain).

(*b*) All strains of *paramelitensis* (none of the three anti-*paramelitensis* sera was able to agglutinate more than two out of the three strains).

(*c*) All strains of *abortus* (none of the four anti-*abortus* sera agglutinated more than four out of the eight strains).

(3) No strain was agglutinated by all the anti-sera. But certain strains were agglutinated by all the homologous anti-sera, e.g., *melitensis* Ch. 8, and the Oxford standard agglutinable culture *melitensis*, *paramelitensis* Ch. 83, *abortus* No. 5, and the Oxford standard agglutinable culture *abortus*.

It must not be forgotten, however, that organisms vary enormously in their agglutinability, and that two cultures made from the same strain at different times may show a marked difference in titre of the serum tested. This is well shown in Table II, comparing the Oxford standard agglutinable culture *melitensis* with a culture of the same strain prepared in this laboratory.

In the same way a serum of a rabbit immunized with a specific strain of an organism may fail to agglutinate this strain, although able to agglutinate other strains of the same or closely allied species. This is also shown in Table II in the case of Zammit serum, which showed no agglutination with the homologous immunizing strain, but did so with other strains of *melitensis* and one strain of *abortus*. Various observers have given examples of these points [5], [6].

It therefore appears that a serum prepared by immunizing a rabbit with any killed strain of the Brucella group may fail to agglutinate an organism

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TABLE II.—This shows the Highest Titres obtained on Testing the twelve Prepared Sera and two Human Sera against eighteen Different Strains of the Brucella Group.

Cultures	Sera													
	melitensis					*paramelitensis*			*abortus*				Human	
	Oxford S.A.C.	Oxford (Caprini)	W.P.R.L.8	Zammit	D	Bassett-Smith	"2065"	Ch. 83	No. 8	Swine	Oxford (Bang)	Oxford S.A.C.	Mrs. R.	D
melitensis Oxford S.A.C. ..	250	500	500	250	250	125	*Nil*	250	250	250	*Nil*	*Nil*	250	500
,, Oxford (Caprini) ..	125	500	125	125	125	*Nil*	*Nil*	125	*Nil*	125	*Nil*	*Nil*	250	—
,, W.P.R.L.8 ..	*Nil*	250	250	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	250	—
,, Ch. 8	250	500	500	250	250	125	250	250	250	250	250	*Nil*	250	500
,, Arkwright	*Nil*	*Nil*	*Nil*	*Nil*	125	*Nil*	125	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	250	—
,, Zammit	*Nil*	*Nil*	*Nil*	*Nil*	125	125	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	—
,, D	250	*Nil*	*Nil*	*Nil*	500	250	250	*Nil*	*Nil*	250	125	*Nil*	*Nil*	5000
paramelitensis Bassett-Smith	*Nil*	*Nil*	*Nil*	*Nil*	250	125	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	500	—
,, "2065" ..	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	125	250	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	—
,, Ch. 83 ..	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	250	250	250	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*
abortus No. 5	*Nil*	250	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	250	250	500	250	2500	—
,, ,, 8	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	125	*Nil*	*Nil*	*Nil*	500	—
,, ,, 11	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	—
,, ,, 28	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	250	—
,, Hog	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	—
,, Swine	*Nil*	125	125	*Nil*	125	*Nil*	*Nil*	*Nil*	*Nil*	250	250	125	500	—
,, Oxford (Bang) ..	125	125	250	250	125	*Nil*	*Nil*	125	500	500	500	125	500	—
,, Oxford S.A.C. ..	125	125	250	250	125	*Nil*	*Nil*	125	500	500	500	125	500	*Nil*

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recovered from a case of clinical undulant fever, i.e., it has not the agglutinins specific for that organism. It is then necessary to try to find an organism which does possess a sufficiency of those agglutinogenic substances which are able to evoke in an immunized animal the agglutinins for all strains of the species of the organism in question, i.e., *melitensis*, *paramelitensis* or *abortus*. This is merely an extension of Durham's theory to strains instead of groups and species.

As a general rule each species has one agglutinogen common to all strains of this species and in excess of any agglutinogens for other allied species, so that any strain causes the production of an agglutinin or agglutinins for all strains of that species. This, as has been said, does not appear to occur in the sera of immunized rabbits, but appears at any rate to be much more obvious in the sera of cases of human infection (see Table II). This suggestion is supported by the numerous positive agglutination reactions recorded by observers in other countries, as has been already mentioned.

The failure in the agglutination results shown in Table II would thus appear to depend upon one of two things:—

(*a*) The cultures: These were prepared as already stated. Dead organisms are agglutinated as easily as living ones, and Dreyer [5] holds that daily subculture of an organism for two to three weeks both stabilizes and increases its agglutinability, so that although the cultures were made from stock ones and might have become deficient in agglutinability, the frequent subculture employed should have made the final culture reasonably sensitive.

(*b*) Lack of agglutinogenic components in the organism used for immunization. The killing by heat of some organisms is known to cause a loss of antigenic properties, and it is quite possible that killing by other means may alter to some extent the agglutinogenic content. In the case of human sera the reaction is of course caused by living organisms. Rabbits will usually tolerate living organisms when given intravenously, and then one can be certain that the bacterial protein is unaltered.

For this reason I have started in this laboratory to use living cultures for immunizing the rabbits, in an attempt to obtain a serum which will show agglutinins for all strains of a species which at present a prepared serum for any of the species of the Brucella group lacks.

I am indebted to Colonel A. C. H. Gray, Professor of Pathology, Royal Army Medical College, for the benefit of his advice and permission to make the investigation.

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SOME ASPECTS OF ADMINISTRATION.

BEING THE MAJOR PART OF A LECTURE AT THE ROYAL ARMY MEDICAL COLLEGE, SEPTEMBER 2, 1929.

BY LIEUTENANT-COLONEL M. B. H. RITCHIE, D.S.O.,
Royal Army Medical Corps.

LARGE OR SMALL STAFFS?

LET us begin with some matters concerning staffs. As a rule, the big men in history carried on with small, subservient staffs, designed only to carry out the orders of the superman. Napoleon, for example, had the greatest staff officer of modern times—Berthier; you should read about him. Napoleon would stride up and down declaiming his intentions and orders. Berthier could get these re-shaped and issued. He was the "complement" so to speak, of Napoleon, who said of him at St. Helena that as a staff officer he had not his equal, but as a commander he could not lead five hundred men. Here is a fact that has so often shown itself in your own experience—the good commander may be a poor staff officer, and vice versa. The qualities required for these two jobs are different.

Napoleon's system is interesting. He had marshals in command of his big formations who were equal in rank. This led to jealousies, even to trying to cramp each other's style. You find the same thing in Von Kluck's book about the German First Army at the beginning of the war; there was jealousy of another army commander. Napoleon did not issue "orders," strictly speaking, but general instructions. He did not expect blind obedience; he wanted general co-operation, with initiative.

Wellington was rather the opposite. He had indifferent material, in his early days, to work with, and he developed the "one-man-show." He gave orders. Right or wrong, though the situation had changed, his orders had to be carried out. He would brook no interference, no initiative. The battle was planned in his brain, he controlled everything in his own hands; no man could have taken over from him.

Being a "big man" the system worked well, but the man at the top cannot carry on in this way to-day. He had the smallest of staffs and the scantiest of orders. The Assistant Quartermaster General acted in the capacity of C.G.S., A.G., and Q.M.G., all rolled into one. Wellington's dispatches are masterpieces of good English; but the orders issued by his staff would not help a man to pass an examination to-day—even the hour at which they were issued was not inserted.

There you have two types to choose from, the co-operation method of Napoleon, the "one-man-show" method of Wellington. The tendency has been to increase and augment staffs since those days, to give staff officers special training for their duties. When you get into higher administrative appointments you are never likely to lack for assistants, official or

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unofficial. You have technical advisers also. You must think out how your mind will react towards this. You will be led to delegate as much as you can, and it is sound. Do not get your mind filled up with details. There will be no room for the big things if you do. You must trust your subordinates; give them as much autonomy as you can, but know what they are doing. You yourself must never get clogged up with correspondence, so that you have to stay in when you ought to be going around. There is no special advantage in having a meticulous mind in a high appointment.

Your staff must become your mind to some extent, and you must keep yourself free from routine so that you can survey your service as a whole. Learn to control without fussing; our organization is based on team work, and you must learn how to run a team. But, even to-day there is room for the "one-man-show" method, and sometimes it may "pay."

Policy.

Above all, when you are in a big job, you must work on a policy. However uninterfering you are, however much authority you have delegated, you must be an autocrat in policy. What I mean by policy is that you must lay down the lines to go on, a definite attitude towards hospitals, C.C.S.'s, evacuation, etc. You get together a definite policy on every important head. Tabulate your policy and stick to it as far as you can. Let your subordinates know it, and so long as they are working up to your policy, and within your policy, you need not worry. You must be ready to modify policy to meet new situations, without chopping and changing too much. Remember, however, that in a high appointment your wishes and orders carry a long way. They go slowly, you have to look ahead, and the chances are that your schemes will not bear fruit for a long time.

The Test of War.

There is a type of man and mind that may become brilliant in war, even though inconspicuous in peace. The big man will shine in peace and war, but the last war showed us that many who were not in the first flight in peace became administrative "stars" in war. Another type of mind goes high in peace, but is hopeless in war. War and peace, in the medical services, have little relation with each other. You may fail time after time in the promotion examination and become a brilliant administrator in war.

I remember, after the war, how my chief, a good war man, used the expression, "We must get rid of these slack war-time methods." It was perfectly true, but a bit of a shock, if you think about it, in an army that had just won a war. He was thinking well ahead, and saw that we must return to the old, stricter control of peace. Remember the hackneyed phrase, "Thank goodness the war is over, and we can get back to real soldiering." And the bother about it is that there is something in it. Peace and war, so far as you are concerned, have little connection with

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each other. You cannot learn all about future war by studying the last. You must go in with mind, eyes and ears wide open, and learn as you go along.

Personality.

Men differ so much. How are you going to tackle the question of developing your personality if you are dealing with generals and people in other branches?

You know that much of our administration in war hinges on personality. In so many cases it is a matter of getting someone to give you something. That is what success boils down to. One man gets everything; another can get nothing. If the medical service is to do well, its head must be in close touch with, be "liked by" the man who can hand out the goods; so however brilliant one may be, if one does not gain the confidence of the men in authority, things will not go well. Is it not largely a matter of developing a superiority complex? At any rate, the inferiority complex, real or imagined, will never get anything. There seems no room for modesty and shyness; they are positive vices in war. Personality, I think, depends upon being natural and un-shy, demonstrating that you know your job and can run your show.

Staff Officers *v.* Clerks.

Some men do not want staff officers—they want clerks. You see what I mean? You must analyse your own mind and decide what you want as "complement." Do you want a first-class assistant to hold your hand and supplement your brain waves? Will an able and assertive staff officer merely get in your way and frustrate or annoy you? Would you prefer to have clerks only? The answer depends on your individual characteristics and your type of ability. But I think a man should know approximately what type will suit him best as assistant.

A man who has studied war questions in peace may be handicapped by a tendency to revert to pre-war ideas which actual experience has quickly modified—a tendency, for example, to apply 1910 theory to 1918 practice; I mention this because it shows up an important point. You may go into war ignorant of technical administration, but you may learn very fast in a hard, practical school; and you may outclass the more diligent and painstaking, if they employ pre-war methods and ideas that are at a discount in comparison with your actual experience. The vigorous, practical realist, none too brainy, perhaps, but full of worldly wisdom and common sense, can prove himself to be the better administrator.

Administrative Courage.

It was very remarkable how many of our senior officers showed a fearlessness amounting almost to recklessness in the forward area. Some of them revelled in this—they seemed to be born without sense of fear, or to have suppressed it. You can take it as a general rule that the fearless type in war will be fearless in administration, but not always; nor does the converse hold good. Administrative courage is an essential; it must and can be

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cultivated. You need not be a fire-eater, but you must develop the sense of administrative courage.

It is hard to do, I admit. Let me explain what I mean. You ask for, or recommend, the issue of some important article. You say it is absolutely necessary. The other fellow does not mean to let you have it, and asks you if you really want it, in rather roundabout language. You say you must have it; there it is. "That's that." Then you are told that you are recommending this for one unit, and if given to one it must be given to all; there are 200 units, the cost will be enormous, and what about it? Then you begin to think. And so the essential becomes a luxury, and the recommendation fizzles out. Men can be frightened easily by costs. So, courage is wanted to deal with administrative matters. You must know what you want, put up a good case, have your expert or your chief behind you, and go forward with a stout heart. But the stout heart of the front line trenches may quail before the financial bomb, while feet that are cold on a duck-board may carry their owner into a general's sanctum, in vigorous expostulation against some matter which the fire-eater has taken "lying down." You can never tell. We must learn through experience how to stand up to other branches, and cultivate the supreme faculty of getting what we want. As a rule, everyone is out to help. But you may come up against someone who will not give you things—from principle, which is serious; from economy, which can be overcome in war but not in peace; or from sheer cussedness and pig-headedness, frequently the offspring of ignorance out of personal dislike.

The Lazy Fellow and the Obstructionist.

Two types of individual with whom you will have to deal should be analysed, the lazy fellow and the obstructionist. The world teems with them. Every time I say give me the lazy fellow. Beware of the obstructionist; he is dangerous. There are points about laziness. It is not a vice. If you really want to get work out of a lazy man, you can get it; you can throw self-control to the winds, curse him, even beat him; if stirred up, he will work like a Trojan. He is the only man whom you need not treat with the slightest respect; he acts as a safety valve for ebullitions of temper. No, I do not mind laziness. But Heaven preserve me from the professional obstructionist in war. The history of military disasters is a continuous record of obstructionism. Your obstructionist is able, capable, argumentative, full of plausible reasons. You can do nothing with him. If one is in the way, however far down the military scale, he will put a road-block across your route to success. He is incurable. There is only one thing to be done with him. Send him home. But the trouble is that he may be immune from you. You may not even know him. In a service like ours, which operates by recommendation, by getting someone to give you something, where you cannot go into a shop and buy for yourself, obstructionism in an issuing department will wreck our schemes entirely. I think that the obstructionist more than any other bad type in

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war, such as the inefficient, the lazy, the cold-feet merchant, is the one type of man who must be put down ruthlessly. But, alas! he is probably in a high place and out of your reach. He is a hard nut to crack.

Higher Administration.

I want you to keep in mind that the work of medical administration of a Division is different from the work of the higher formations. In a Division you are "spoon-fed." You have a War Establishment. You get your additional equipment, perhaps with difficulty, from the next highest formation. You have to know how to operate the medical service of a Division, and you are examined on it.

I will not touch on that, because you pick it up elsewhere. But, suppose you are suddenly called upon to organize something new. Your books do not help you; in a thousand ways you have to tackle entirely new problems. In organizing a new base, or as a "D.M.S. of an independent force" your own imagination, your *flair* for administration, will be your sole stock-in-trade. Remember in such circumstances that you must appreciate quickly the way that you are going to get things. Nothing worth having will drop down from heaven, and you will not be allowed to order things over the 'phone, or in a shop, as in civil affairs.

Medical personnel will be in your own hands, or under your own people. You will not have much bother over that. Medical stores are simple, being also in your own hands. But these things carry you nowhere. The business parts of the medical service are obtained from other services, and you have got to induce someone to order or convince someone else, who is probably busy over ammunition or guns, that beds, blankets and stretchers, tents, furniture and transport, are wanted at once for the medical services. You go to "A," who has to go to "Q." Everything that is vital, save personnel and technical equipment, is under "Q," and you can only reach him officially through "A."

So you must have the gift of getting people to give you things. You must have the *entrée* to the Commander; whether it is allowed or not, fix up to see him every morning. You can pour all your troubles into his ear and, if he gives an order, things get done. See to it that he visits your medical units. You can talk at conferences, you can get to know people well at mess—often you can do a little bartering. (I once got a 'phone by sanctioning an issue of rum; we got a concrete floor for a cookhouse through lending the Chief Engineer a car.) You must bring all these methods into play; you must learn the correct official channels, and know unofficial methods. But, as the system stands now, you can supplement and speed up by the display of personality. You should get your experts to back you up whenever you can, and your own people next above you. You must put things on paper, you must get your "A" to help. Work through him, get him on your side, and keep in close touch with your own people, and do not forget that in war you work under abnormal conditions. You cannot go on peace standards. Yourself, you may be fatigued in mind and

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body. Your comrades may appear intolerant, discourteous, impossible. One man, upset by forward area conditions and neurasthenic, may scorn the man at the formation above him. (The old grouse against the Brigade or Divisional Headquarters.) Or the forward area man may have his tail right up, while "base limpet" may be unfit and overworked. We must always make allowances for overwork, slight shell-shock and narrow minds. The cheerful, tolerant optimist seems to me to be the best type for a high administrative job in war, when everyone is working at high pressure.

Remember, then, when you are administering the medical service of a formation other than a Division, you will find that the big things cannot be done by issuing orders. For instance, you will find that you cannot move personnel, or a medical unit, from one subordinate formation to another. You have not the power to do so. We had constant trouble over this point in the war. All these moves must be done by "A." You state what you want and request him to issue orders. Within the Division it is different, as the A.D.M.S. commands the R.A.M.C. of the Division.

To summarize on this aspect of administration, then, you must think big, and have clear-cut views on what you want. You must put a great deal, far too much, in writing. You must be one of the Commander's "friends." You must have "A" helping you actively. You must know "Q" well, and be on the best of terms with Ordnance, Transport, Engineer and Supply Services. You must exploit your Voluntary Aid organizations, and never let them feel that they are "cold-shouldered." They may be the most powerful levers you possess, if you handle them properly. And remember the publicity or journalist aspect of administration, to have a "good Press." In a few words, you must be definite, forceful, friendly and modern.

The Need for an Objective.

I would like to refer, in simple terms, to the intangible asset of objective, or motive, in any big organization or public body. No service can flourish without an objective. *Esprit de corps* and efficiency are bound up with it. Take, for example, such public bodies as the Salvation Army, the Red Cross Societies, the Scouts and Guides—in each there is a great objective; in all it is service to others, in different ways. This motive force of service to others is a feature of our mentality to-day. It has entered politics now. Or again, the results of *Fascismo* in Italy—how Mussolini has got the Italians behind him as a united, purposeful nation. He is efficient, but that is not all. He has inspired every Italian with a great objective—to restore to Italy the glories and the prestige of ancient Rome. With this he has fired an imaginative people with the will to go forward and become dominant.

With us in the British Army, we had a great objective, a subconscious one, before 1914; we were preparing to withstand an onslaught. Our own Corps prepared as much as, more than, other branches. Now in these

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post-war days that objective has gone. We have the lesser one of maintaining efficiency, of carrying on. But whatever the Army, as a whole, may have in the way of objective, I insist that we, as a Corps, have a great objective before us, here and now. We have the whole field of medical science before us. I refuse to look at the objective of our Corps as one that is limited to the routine treatment and prevention of disease in a small peace-time army. We are well qualified, we have imagination, we serve in widely-scattered areas of the world. We must look on ourselves, I say, as a subsidized service which can operate well ahead of the civilian profession in the unexplored regions of research. We can be the path-finders. I hold that we have the chance to become the spear-head of the profession. Think this over, I suggest; do not turn it down without consideration. It is so easy to pull schemes and conceptions to pieces; so difficult to forecast what will catch on and fructify.

Administrative Invention.

For there is not only scope for individual research; there is wider scope for administered, co-ordinated or controlled research. We have the machinery ready. Think over the bigger aspect of peace administration. Not routine administration which everyone knows, the signing of forms, the general supervision of a hospital or a command, but the wide, undeveloped field of professional administration. It concerns the big subjects, surgery, hygiene, pathology. You must be very modern-minded and speculative. Greatness awaits the men who tackle this aspect of administration, who begin to be inventive in their outlook towards higher organization, and who can learn the lessons of modern business administration and apply them to medical affairs.

What I suggest is recognition of the possibilities of invention in administration.[1] If you have studied army history, you will remember how our army was steadily reorganized, the greater changes taking place with the Cardwell reforms. It is on the Cardwell system that our army is built up and recruited to-day. There was a period of administrative invention in which common-sense principles and business methods were followed. Army administration has changed very little since Cardwell's days. Is it not time that we began to overhaul our machinery and see whether we can improve upon it? You should think about administrative invention applied to medical advances, and begin to develop ideas about the co-ordination of investigation and research within the Corps, then among the medical services of the Crown, and, finally, the medical services of other nations.

All these services are attacking similar problems; they have the same aims. I hold that we should co-ordinate our efforts towards these aims.

[1] The term "Administrative Invention" is not mine. I heard it used by Professor Graham Wallas, University of London, and have borrowed it from him.

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Rationalization of a Medical Service.

Rationalization is a term applied to the reform of industry. Briefly, it means cutting out everything that is redundant or unsound, concentrating on increased production with lowered costs, and using common-sense up-to-date methods of administration, marketing, etc.

Now, in hygiene, we aim at the elimination of bad conditions. The application of hygiene to the army is rationalization of military life in peace and war. I think we should have in our own minds a general policy of rationalization of our service, in whatever branches we may be working, even an unofficial, personal policy, and try to keep modernization always before our eyes. What I am suggesting is the creation of the will to rationalize, recognition of the fact that no service, least of all one that is a scientific, progressive service like ours, can ever stand still. I feel that we must have among our younger officers an outlook that visualizes the new objectives of a medical service; we must have a widespread, active urge towards the elimination of bad conditions, because virtual or real toleration, summed up in the common phrase "we cannot do this because" is a frame of mind, a mental attitude, that is far too common to-day among all public services. That attitude of mind in business leads direct to the bankruptcy court. The world has changed, men's minds have changed, and we must not allow ourselves to lag behind.

Here, at this College, you have had the incomparable benefit of a course of adult education. I think that a course of instruction gives a man a chance to develop his intellect at a period of life when he is capable of increasing fourfold his mental capacities, and his utility in the world. You leave the College on your highest levels of professional efficiency; it is for each of you to realize this, and to decide whether you are going to maintain that level, or let it be lowered by allowing interest to slacken. You must face this, and re-act according to your individual standards of determination.

Then there is a second point. This is the fact that reading for any course, on any subject, may give you the stimulus to take a more intelligent interest, to develop wider, bigger views, on higher administrative problems. One thing leads towards another. You begin to think, to detect faulty methods, to see new possibilities. You begin to come into contact with intriguing problems, with administrative chances, that may make life in the higher ranks worth while! Even if you allow your professional standards to droop, perhaps from lack of clinical material, you have the opportunity to apply your technical, scientific knowledge, when it is really up to date, to the rationalization of a medical service, to army medical administration in peace and war. These subjects must be taken up while you are young in mind, and yet old and experienced enough to know where the scope for reform lies, to understand that simplicity and "horse-sense," fair-mindedness and broad-mindedness, sympathy and a sense of humour, are some of the qualities which, if in action among a body of men, will raise administration high above its dull levels of monotonous routine, where too many have been content to leave it.

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ACRIFLAVINE: ITS USE, BY INTRAVENOUS INJECTION, IN THE TREATMENT OF GONORRHŒA.

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(This paper is the clinical part of a joint paper read at the Celebration of the Centenary of the School of Medicine and the International Congress of Tropical Medicine and Hygiene at Cairo, December, 1928. The second part of this joint paper, which embodies the details of the experimental work carried out with and by R. St. A. Heathcote, Professor of Pharmacology, and A. L. Urquhart, Professor of Pathology, both of the School of Medicine, Cairo, is published in the *Journal of Pharmacology and Experimental Therapeutics.*)

I.—Introduction.

Commencing with Paracelsus at the beginning of the sixteenth century, the history of chemotherapy is long and interesting, but need not be considered here. In later years, however, undoubtedly the most distinguished member of this School of Physicians has been the late Paul Ehrlich, who adumbrated the idea of a therapia magna sterilisans and who introduced, in furtherance of this idea, salvarsan and neo-salvarsan. Unfortunately, it has not been possible as yet to discover any drug which fulfils the two postulates of this therapia, namely: (1) that the drug shall destroy all organisms which may affect the host, and (2) that it shall do so without producing more than minimal toxic effects on that host. Many drugs are known which will act on *one,* and usually only one, organism and at the same time obey the second of these postulates, e.g., quinine in malaria, arsenic in syphilis, antimony in bilharziasis, etc. Recently, attention has been paid to the possibility of administering drugs which will increase the bactericidal power of the blood-serum, or which are themselves more actively bactericidal in the presence of serum than in that of water without at the same time damaging the host. Of these drugs several are members of the aniline dye series, e.g., methyl (or gentian) violet, brilliant green, trypaflavine, proflavine, and the drug which forms the subject of this paper, acriflavine.

II.—Literature.

In 1917 Browning and Gilbrandsen [3] published a paper in which they stated that di-amino-acridine had been found to be more strongly bactericidal in the presence of serum than in that of peptone water. On further investigation they found that the methyl derivative of this dye, acriflavine, was even more potent under these conditions and that it was,

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in fact, the most powerful antiseptic in the presence of serum yet known. It was found to be relatively non-toxic to mammalian tissues and to exert no harmful influence on the process of phagocytosis, except in solutions of very great strength.

Further papers were published by Browning and his collaborators [4], [5], [6], [7] on the same subject, emphasizing the activity, as a bactericidal agent in the presence of serum, of acriflavine as compared with that of other better known antiseptics.

Fleming [15] stated that acriflavine, under the conditions of his experiments, tended to inhibit the activities of leucocytes.

The papers mentioned above seem to be all that have been published, dealing with the dye from the bacteriological standpoint. In addition Meleney and Zau [24] have published the results obtained by the intravenous injection of single doses of acriflavine in rabbits. They found that in the dose of 25 milligrams per kilogram of bodyweight, it invariably caused death within six days, and that in the lesser dosage of 12·5 and 5 milligrams per kilogram death resulted within fourteen days in about one-half and one-fifth of the cases respectively. Death was found to be associated with degenerative lesions of the liver and kidney.

Turning now to the clinical literature, we find that acriflavine has been recommended for use as a local dressing for wounds [12], [19], and in dermatological cases [1], [2], [18]. Again, an instillation of 1 in 1,000 has been used in gonorrhœal ophthalmia [27]; in gonorrhœal urethritis it has found favour as an irrigation in a strength of from 1 in 500 to 1 in 8,000 [20], [21]. In chronic ulcerative colitis it has been employed in a strength of 1 in 4,000 [11], and in amœbiasis in a strength of 1 in 500 [26]. Apart from these purely local applications it has been advised that a dose of from 5 to 10 cubic centimetres of a 2 per cent solution should be given intravenously, intramuscularly or subcutaneously in the treatment of gonorrhœa [8], [13], [14], [17], and of epidemic encephalitis [9], [16], [25].

For a description of its appearance and of its physical properties, reference may be made to the "Extra Pharmacopœia" [22].

III.—Clinical.

In the following pages will be found a description and analysis of cases treated with acriflavine intravenously, numbering 118 in all. Of these six were dermatological in nature and the remainder cases of gonorrhœal urethritis, with which this paper is chiefly concerned. It was decided to select this disease for treatment in this manner for two reasons: (1) there was a sufficient number of cases available to afford a proper number for treatment and for control, and (2) the disease is one in which definite foci of disease exist, which foci should, at least theoretically, be vulnerable to the attack of bactericidal agents circulating in the blood-stream.

All cases were treated on the same system, the procedure being the administration intravenously of 5 cubic centimetres of a freshly prepared

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2 per cent solution twice weekly. The actual dose was, therefore, 100 milligrams, approximately 1·5 milligrams per kilogram. The smallest number of doses received by any case was five, 500 milligrams, the largest twenty-six, 2,600 milligrams.

The cases treated may be classified into groups of primary infections, re-infections and relapses, as shown in Table I below, in which they are further subdivided in accordance with the number of doses received by each.

TABLE I.

Number of injections	Nature of case			Total
	Primary	Re-infection	Relapse	
5	3	1	2	6
6	6	3	3	12
7	4	1	2	7
8	4	1	1	6
9	8	5	4	17
10	15	6	5	26
11	2	0	3	5
12	4	0	2	6
13	2	2	0	4
14	3	2	1	6
15	1	0	1	2
16	1	1	2	4
17	1	1	0	2
18	1	1	0	2
19	0	1	0	1
20	2	0	1	3
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	1	1
26	0	1	1	2
Total cases	57	26	29	112

In order to obtain a stringent test of the usefulness of this method of treatment, it was decided not to employ the drug invariably at the commencement of the disease, but rather to wait until it had become established. This applies more particularly to the groups of primary infections and of re-infections rather than to the group of relapses in which cases the disease is already well established. Table II shows the periods of time which had elapsed from the onset of the disease before treatment with acriflavine was commenced and during which treatment with the older methods was carried out.

TABLE II.

Days from onset	Primary	Re-infections	Relapses
1 to 10	3	1	6
11 ,, 20	4	3	9
21 ,, 30	14	8	3
31 ,, 40	7	4	2
41 ,, 50	6	1	4
51 ,, 60	8	4	1
61 ,, 70	7	0	1
Above 70	8	5	3

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In order to establish a basis for comparison, the average duration of treatment in the series of cases in which acriflavine was and was not used respectively has been worked out. The results show that, for 57 primary cases in the acriflavine series, the duration was 97 days as against 57 days for 57 primary cases in the control series; for 26 cases of re-infection in the acriflavine series the duration was 91 days as against 48 days for 26 cases of re-infection in the control series; and, for 29 cases of relapse in the acriflavine series the duration was 80 days as against 43 days for 29 cases of relapse in the control series. The average stay in hospital for all cases was, in the acriflavine series 90·6 days, and in the control series 51·3 days.

The objection may be raised that this average period of 90·6 days includes the period during which the ordinary methods of treatment were being carried out. This, of course, is true, but is certainly invalid as criticism. The patient should have been cured earlier, not later, if acriflavine is of any merit in the treatment of the disease. Another objection which may be made and which may have some slight force is that all the cases treated with acriflavine were those which tended to be chronic. This is true, but the fact can hardly explain the great increase in the period of treatment found, from about 50 to about 90 days.

Of the cases treated with acriflavine, some had already developed complications before the special treatment was instituted; these comprised 11 cases of epididymitis, 3 of prostatitis (1 with concurrent epididymitis), 1 of perineal abscess, 2 of arthritis (1 with concurrent epididymitis), and 6 of posterior urethritis. In cases which had received or were receiving acriflavine intravenously, 8 developed complications: 2 of epididymitis, 2 of prostatitis, 2 of infiltration and folliculitis of the anterior urethra, 1 of arthritis and 1 of cystitis. This is to be compared with 23 cases which developed complications before the treatment was commenced, and with 20 cases from the control series which developed similar complications under the ordinary methods of treatment.

With regard to the occurrence of relapses, among the 57 primary cases treated with acriflavine, 6 relapsed after passing the tests for cure; similarly, of the 26 reinfected cases 4, and of the 29 cases of relapse 4 also relapsed. Among those of the control cases, the corresponding figures are: of 57 primary cases, 7 relapsed; of 26 re-infected cases, 5 relapsed; and of 29 relapse cases, 4 relapsed.

IV.—Toxic Effects.

In the literature concerning the clinical uses of acriflavine, there are occasional references to the appearance of toxic effects following its administration [13], [14], [17], [23]. These are divided, according to the delay preceding their onset, into two classes: (1) "immediate," and (2) "delayed."

"*Immediate.*"—Various symptoms have been described, none of which have been serious. Some patients have suffered from slight syncopal

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attacks [13], [17]. Others have complained of a burning sensation or of constriction of the throat [14], [17]. Again, there has been a bitter taste in the mouth and throat [13], [14]. Congestion of the face has occurred [17]. A feeling of warmth in the perineum has been noticed [17]. A local urticaria at the site of injection has been observed [17]. Transient palpitation and even vomiting may occur [14].

In the present series of cases there were two of mild shock. Others suffered from flushing of the face with a sensation of choking. They had a slight degree of cough, and several vomited after the delay of one or two hours. In the evening there was often a slight pyrexia, followed on the same or the next day by urticaria.

"*Delayed.*"—Towards the fifteenth day of treatment a cumulative toxic effect has been seen to occur. The symptoms observed have included slight nausea, cardiac irritability and staining of the skin [17]. It has been stated that injections cannot be repeated more than four or five times at weekly intervals without the risk of the appearance of dangerous symptoms. Unfortunately no details are given in the abstract of this paper [23], the original not being available.

In the present series of cases no symptoms corresponding to these have been observed to occur at the periods stated.

In the literature there seems to be no reference to a further set of toxic appearances, occurring still later after the injections. These, to be described below, may be classified as "late."

"*Late.*"—In about 11 per cent of all cases treated with acriflavine by the intravenous route, the patient was re-admitted to hospital after a lapse of eight or more weeks suffering from catarrhal jaundice. These cases will now be considered.

A few months after the institution of treatment with acriflavine given intravenously, it was noticed that, among the patients admitted to hospital with a diagnosis of catarrhal jaundice, there were several who had previously undergone this course of treatment. They were admitted to different hospitals within the area, and some little time naturally elapsed before the possibility of there being a causal connection between the treatment and the occurrence of jaundice was considered. As soon as this possibility was envisaged, all cases of catarrhal jaundice arising in the area were reported to the Venereal Department. It was then found that the incidence of catarrhal jaundice among those who had been treated with acriflavine was 11·02 per cent, while the incidence among the remainder of the troops in the Command was only 0·32 per cent.

The next table, Table III, gives the essential details as to the treatment of the thirteen cases which developed jaundice.

Analysis of the cases of jaundice showed that the incidence of this complication was purely fortuitous. No relationship could be traced between the total number of doses administered and the occurrence of jaundice. Again, no connection could be observed between the season of the year and the number of cases developing.

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TABLE III.

Case	Number of injections	Date of last injection	Admitted hospital	Discharged hospital	Incubation period	Period in hospital
T. B. ..	13	14.9.26	5.12.26	23.12.26	82 days	20 days
McC. ..	9	14.9 26	6.12.26	12.1.27	83 ,,	37 ,,
R. W. ..	8	15.1.27	31.3.27	23.4.27	75 ,,	26 ,,
C. ..	16	15.1.27	16.3.27	21.3.27	60 ,,	6 ,,
N. ..	10	25.1.27	21.4.27	9.6.27	86 ,,	50 ,,
M. ..	12	22.2.27	2.5.27	6.6.27	69 ,,	35 ,,
A. N. ..	10	5.2.27	30.4.27	21.5.27	84 ,,	21 ,,
S. ..	10	22.2.27	4.5.27	24.6.27	71 ,,	52 ,,
B. E. ..	14	6.9.26	31.10.26	Died	55 ,,	21 ,,
D. ..	9	19.3.27	25.5.27	11.6.27	96 ,,	17 ,,
A. ..	10	29.3.27	9.6.27	18.6 27	72 ,,	9 ,,
S. ..	7	29.3.27	2.8.27	26.8.27	126 ,,	24 ,,
G. ..	11	22.2.27	11.6.27	2.7.27	111 ,,	22 ,,

With regard to the incubation period, i.e., the interval of time elapsing between the date of the last injection and the commencement of jaundice, the average delay is 82·3 days. There is a maximum at about this figure, four cases occurring after periods of 82, 83, 84 and 86 days respectively. There was no change in the method of administration and the dye used was all of the same provenance.

So far as the nature of the cases of jaundice is concerned, leaving out of account the one fatality, there is nothing of interest to report from the clinical aspect. The average stay in hospital was 26·3 days, the longest 52, the shortest 6, figures which are in reasonable accord with those for the other cases of catarrhal jaundice admitted during the same period. One case suffered from a relapse after three weeks' interval and was re-admitted for a further period of fifteen days. There was a considerable variation in the degree of icterus present. Itching was not observed. The clay colour of the stools, so typical of catarrhal jaundice, was not well marked. The following case may be cited as typical of all.

Case M.—Received twelve intravenous injections of acriflavine, each of five cubic centimetres of a 2 per cent solution in distilled water, between January 20 and February 22, the total amount administered being 1·200 grammes. Jaundice occurred on May 2, sixty-nine days after the last injection.

Symptoms.—Some malaise; depression, slight; itching, absent.

Physical Signs.—Icterus, moderate on admission, skin clear on 10th day, conjunctivæ still slightly tinted on 20th day; urine, bile pigments present until 20th day; stools, slightly pale in colour; pyrexia, slight on 2nd, 6th, 7th, 8th days, with occasional evening rises later; liver, never palpable but some tenderness at the costal margin.

On the thirtieth day the patient had completely recovered and no further signs or symptoms occurred.

Among these cases, however, there is one of considerable interest and importance, that in which death was the result. The patient developed jaundice and died on the twenty-first day of the illness, the diagnosis being acute yellow atrophy of the liver. This was confirmed at the post-mortem examination. The details of the case are subjoined.

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Case B.—Aged 23. Received ten intravenous injections of acriflavine, each of five cubic centimetres of 2 per cent solution in distilled water. The total amount administered was 1·0 gramme. Admitted to hospital on the fifty-fifth day after the last injection.

Condition on Admission.—Malaise, considerable; jaundice, well-marked; temperature, normal; liver, enlarged, palpable and tender; spleen, palpable.

The temperature, normal on admission, soon became raised, and was usually between 99° and 100° F. in the evenings. On the seventh day the liver was two inches below the costal margin, but on the sixteenth day, though still palpable, it was reduced in size. At the same time the degree of icterus was more intense, and vomiting occurred after all feeds. On the nineteenth day the patient was worse; the vomiting was less but the vomited matter contained blood. There was a marked leucopenia, only 1,400 white cells per cubic millimetre being present. On the twentieth day the patient had become semi-comatose and had retention of urine. On the next day the coma deepened and the patient died.

The post-mortem report confirmed the diagnosis of acute yellow atrophy. Heart, dilated and flabby, old fibrotic vegetations on the mitral valve; lungs, both adherent to the parietal pleura and to the diaphragm; abdomen, adhesions between parietal and visceral peritoneum; kidneys, congested; spleen, soft and friable; pancreas, enlarged and fibrous; adrenals, enlarged and congested; liver, shrunken and flabby, dense adhesions to diaphragm, bright yellow coloration in patches; gall-bladder, collapsed and adherent; bile-ducts, no sign of obstruction, main ducts patent; microscopically, the sections of the liver showed that the glandular tissue was in large part necrosed.

The author is indebted to Major F. G. A. Smyth, R.A.M.C., Pathologist to the British Troops in Egypt, for the foregoing description of the post-mortem findings.

V.—Discussion.

From the preceding pages it will be clearly seen that there are two salient points for discussion: (1) Whether acriflavine, given intravenously, is of greater value in the treatment of gonorrhœa than the older and better-known drugs; and (2) whether any causal relationship between such administration of acriflavine and the incidence of the cases of catarrhal jaundice and of acute yellow atrophy of the liver can be traced.

In considering the figures on which the answer to the first of these questions must necessarily be based, it must be borne in mind that the cases treated with acriflavine do not form a series strictly comparable with those regarded as controls. On the whole, the cases in the former group were more chronic and more severe in nature than those in the latter group. A more stringent trial of the drug has thus resulted than would have obtained had the two series been exactly parallel.

Considering the cases first from the point of view of duration of stay in

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hospital, the cases treated with acriflavine average a stay of 90·6 days, as against 51·3 for the control cases. It seems very doubtful whether this increase of nearly 80 per cent in the period of treatment can be entirely accounted for by the greater severity of the cases so treated.

With regard to the occurrence of complications, the acriflavine series contains twenty-three cases in which complications had developed before treatment with this drug was instituted. Leaving these out of consideration, eight others developed complications after the commencement of the treatment, as compared with twenty in the control series. In view of the greater severity of the disease in the acriflavine series, it will be justifiable to deduce that complications are less likely to occur in cases treated with acriflavine than in those treated on ordinary lines.

Relapses occurred almost equally in the two series of cases. Acriflavine seems therefore to be of no especial merit in preventing the occurrence of relapse.

Turning now to the question of relationship between treatment with acriflavine and the occurrence of pathological changes in the liver, as exemplified by the development of jaundice and, in one case, of acute yellow atrophy, we are immediately struck by the great difference in the incidence of jaundice in the acriflavine series and in the control series, in this case the whole body of troops in the Command. In no less than 11 per cent of cases in the acriflavine series did this condition occur as opposed to an incidence of 0·32 per cent in the control series. This fact alone is sufficient to lead us to the conclusion that there exists a most definite causal relationship between the intravenous administration of acriflavine, frequently repeated, and the occurrence of derangement of the liver.

The cases arose sporadically in different areas of the Command and, so far as could be observed, there were only two points in which the men affected differed from the remainder of the troops: (1) The previous history of gonorrhœa; and (2) the treatment with acriflavine. Naturally, the first of these points is by no means absolutely true as many others had suffered from that disease. It seems that the occurrence of jaundice in these cases must be attributed to some form of idiosyncrasy which was present in about 11 per cent of the cases treated.

VI.—Summary.

(1) Acriflavine, administered twice weekly intravenously in man in doses of about 1·5 milligram per kilogram body-weight, does not possess any advantages over the older methods of treatment of gonorrhœa, either in reducing the duration of the period required for cure or in preventing relapse.

(2) There is some evidence to suggest that, in cases so treated, there is a lessening of the incidence of complications.

(3) Evidence, practically conclusive in nature, is brought forward to show that acriflavine, administered repeatedly in this manner will, in about

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11 per cent of the cases so treated, give rise to derangement of the liver functions.

(4) A case of acute yellow atrophy of the liver, occurring in the series of cases treated with acriflavine in this manner, is described.

(5) In view of these facts, it is suggested that the use of acriflavine by intravenous injection is dangerous.

The author has to express his gratitude to the Director-General, Army Medical Services for kind permission to publish the facts recorded in this paper.

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RING UP THE CURTAIN !

By U. P. A.

(*Continued from p.* 435, *December*, 1929.)

III.

THE route from Dresden to Prague lies through "Saxon Switzerland." This district is so well named that it need not be described. In its wintry setting it was lovely.

Travelling in Germany is as easy as travelling at home. Imagine our indignation and surprise when, at the Czecho-Slovakian frontier, we were held up for over an hour, while a posse of sharp-faced, fussy young officials scanned each passenger suspiciously, examined the passports minutely, and ransacked the baggage with the industry of a pack of terriers in pursuit of a rat.

I missed quite a lot of the scenery while restuffing my suitcase—and Georgina's; but the exercise cooled my temper.

That is the worst of Self Determination. Under its aegis everyone is so young and so keen: so intent on keeping out the sceptic and the smuggler: so intolerant of criticism and even of advice: so full of Ireland and Bohemia: so insistent on what does not exist—tradition: so bent on manufacturing that most difficult of products, esprit; so obsessed with building up what it takes centuries to form—nationality; so poor in pocket, and proud in spirit of doubtful quality. So like the kick of a mule—all energy and no sense.

On the railway bookstall I saw a novel: "Villette," by "Charlottovna Brontëyski." However, even this bright effort will neither rival the utility nor tarnish the glory of the gems of Erse.

In the new Republic of Czecho-Slovakia the difficulties are multifarious. They existed under the monarchy, and they persist just the same under democracy. It is not merely a case of oil and water, as in the Emerald Isle: it is a case of cosmopolitanism, as in the U.S.A. Czechs, Slavs, Ruthenes, Germans, Austrians, Jews, etc., with the Czechs and Slavs holding the reins, the Teutons doing the work and the Jews grasping the purse strings.

Perhaps a really good emulsion will be compounded some day—the day Ulster and The Rest mix. Perhaps. But before taking too sanguine a view of the future, read history, and especially contemporary history.

Naturally, the American Embassy heads the consular list; and in Prague there is, of course, a Wilson Station, and a Woodrow Wilson statue. The great self-determinant regards his handiwork with a fixed, complacent smile. Considering the large amount of alcohol which is made to vanish under his very nose, it is amazing how he does it. There is something to be said for the smile in stone which won't wear off.

The guidebook says: "The public social life of Prague is concentrated

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in the cafés." That is quite true. It is impossible to imagine a more café-ridden city in the world. In Vienna there are hundreds of busy cafés : in Prague there are thousands of crowded ones. They seem to open about 8 a.m., and are in full swing by 10 a.m. They close on the departure of the last customers, at 1, 2 or 3 a.m. Probably many of them never close at all.

It is doubtful if there are any offices, consulting rooms, studios or apartments of the kind, in Prague. If there are, they can only be inhabited by messenger boys, junior typists or charwomen. A business man repairs to the Café Zlichov and there puts through his deals. A doctor haunts the Café Tyn, writes his prescriptions, and rings the bell for the next patient and a fresh aperitif. An artist erects his canvas on a marble-topped table in the Café Jiri, dashes off a portrait of the principal patron and thereby earns a night's repose ; for, be it remembered, the cafés do not provide beds any more than the hotels provide meals.

Our hotel was a modernized, hygienic, labour-saving place. In other words, it had been spoiled, and was no home at all. The manager seemed to think it so efficient as to be capable of cleansing itself automatically. Georgina went out and bought a duster, and the result was gratifying. On the night of our arrival we went into the dining room. There were lots of tables and chairs, but no diners, and a diminutive waiter, aged 12, informed us that there was no food. The hall porter indicated a café across the way and, as this café used to provide us with sustenance in the wee sma' 'oors after the opera, it deserves mention. It specialized in nocturnal activity. It was a big place, panelled in wood, and shaped like the letter L. Its employees were a very nice lot of men ; but they were offset by a gang who must have come from the nether regions, or Nevada. The latter played the most devilish jazz. The patrons were mixed, with a strong democratic flavour. They were packed into the place like sardines so that, what with humanity, beer, tobacco, jazz and a first-rate central heating plant, Georgina's endurance seldom survived more than thirty minutes of it : just long enough to dispose of a simple supper dish. It always reminded me of the old song which began : "Hi ! boys, hi ! boys, who's for a jolly spree ?" and ended : "Hi ! hi ! clear the way for the rowdy dowdy boys !" Yes ; decidedly old-fashioned, except for the bunch from Nevada.

Prague is a picturesque, rather than a fine, city. It is an example of the liaison between the old, the quaintly beautiful and the dirty. It is not so dirty as it was under the neglectful rule of the Hapsburgs : in recent years much sanitary progress has taken place ; but it is still sufficiently smelly and unclean to be, in parts, most attractive.

A list of the churches, museums, galleries and monuments which are worth seeing, would fill half a page. It would also cause severe headache, or profound somnolence, depending on whether you attempted seriously to pronounce the names, or not. Still, sight-seeing cannot be dismissed without saying something about Hradčany.

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Hradcany (it sounds like "H-radcheen") is to Prague what The Castle Rock is to Edinburgh: the feature which makes the city what it is. A bold hill rises abruptly from the river's bank to a height which completely dominates the whole city. Its summit is crowned by a castle which dates from very early times, but which is now, for the most part, of recent construction. Rising above the castle walls are the slender spires of St. Vitus' Cathedral. This beautiful building was founded in 1344. It merits a prolonged visit. The exterior is very fine, and the interior is a veritable treasure house, kept in excellent order and condition. To English visitors the chapel and relics of Good King Wenceslaus are of special interest. The old sacristan swells with pride as he says: "Yes—and did he not go out on the Feast of Stephen?"

You cannot "do" Hradcany quickly, or without a certain amount of fatigue. Rest and refreshment are at hand in the Nezdarik, U Hradu. This is a small restaurant of the exclusive type, situated in the basement of an old house which faces the Archbishop's Palace. Like so many Continental restaurants of that type, it is difficult to find; but its cuisine is worth any amount of tracking. True, I did swallow a large chunk of raw garlic, accidentally. Also, I swallowed it hurriedly.

In about ten minutes I was well on the way to recovery.

Georgina was not as sympathetic as she might have been. Perhaps the spectacle of a hundred per cent. Britisher struggling with a surfeit of garlic is amusing: I do not know. I do know that some folk's conception of the humorous is not mine.

In this new republic there is a Government department bearing the curious and significant title of the Ministry of Unification. You feel that it is a youthful and energetic ministry, full of zeal and push. No doubt its influence permeates and guides all public activities, including subsidized music and drama. Certainly, the programmes at the National and Municipal Theatres indicated a powerful and ultra-patriotic direction, capable of causing cardiac, if not cranial, enlargement in the Czech and Slav communities. But a dearth of German opera in the theatres cannot be compensated for by a plethora of American syncopation in the cafés.

The National Theatre occupies a fine site on the banks of the Moldau. The design is massive, and the interior spacious and simple. Our first opera, or music drama, was Musorgskij's *Boris Godunov*. The story is based on the life of one of Russia's noblest, but most unhappy, rulers; and the score is full of interest and character. The title rôle was played by Nikola Melnikov, an actor endowed with a good physique, a magnificent voice, and histrionic ability of the first order: a very rare combination in grand opera. His portrayal of the unfortunate Czar Boris—a man inspired by the loftiest motives, but haunted by a hideous past—was wonderful. The huge audience was carried away, and Melnikov received a tremendous ovation.

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The next opera, *Norma*, was a great contrast. The composer, Bellini, was born in 1801 and died in 1835. His work, therefore, belongs to a bygone age: an age in which opera was bound by certain conventional forms such as the heroic, the bombastic, and the tunefully tragic. In the old operas the vocal element predominated. As much use as possible was made of the orchestra, but the Wagnerian-Strauss conception was unknown. The uninitiated is often unable to say when a Wagnerian melody or recitative ends and another begins. No such difficulty is encountered when listening to the old masters. Thus:—

(Words in the upper, music in the lower—italicized—lines.)

Come	love a	health to the rolling	wave.		
Ding	*dong ding*	*fiddle-di-diddle*	*dee.*		
You'll	soon be	snug in a mouldy	grave.		
Ping	*pong ping*	*—forte—Trincoma—*	*lee.*		
Mal de	mer and	murder and blood-	y strife; they'll		
Do re	*me fa*	*so la te do*	*he sa—ang.*		
Give me the bird if the		dominant third doesn't	cost me my		life.
Hi diddle diddle the		*cat and the fiddle and*	*RAT-a-plan*		*bang!*

This not an extract from the work of an old master.

It is merely an attempt to illustrate, graphically, the ease with which old opera can be understood and followed. You could not do this sort of thing with Strauss or Stravinski.

Observe how the words fit the music, and how the music synchronizes with the words. Note the last line: the tympani work up a crescendo roll, the whole orchestra is urged to frenzy, the choristers let themselves go and, when the climax is reached ("bang!") the bass drummer and cymbalist overcome the hero's—or heroine's—top note. The heroine—or hero—is assassinated, or commits suicide. The phase is ended and the stage is set for the next round.

In old-fashioned opera you know where you are.

However, on the Continent there is one great drawback to this type of opera: as a rule, the management thinks that what was good enough for your unsophisticated great-great-grandmother is good enough for you. The costumes, scenery, lighting and effects are those of from fifty to a hundred years ago. Money is poured out on a new setting of *Lohengrin*, while *Norma* dies of senile decay. And so it was at the Municipal Theatre: every artifice was needed to keep the illusion alive, but no artifice was forthcoming. Norma, Adalgisa and Pollio ought to typify faith, loyalty and courage, instead of which they only personified silliness, stupidity and slop.

If the director of this theatre wishes to discover the secret of serving up old wine in new bottles, he should pay a visit to the Lyric, Hammersmith.

At this performance the intervals between the acts were longer than usual. The English consider that this is a tiresome feature of Continental play-going. In reality it is nothing of the sort: it is educative and curative. We all know the Britisher of the French and German illustrated papers:

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the man with a toothbrush moustache, plus fours, hobnailed boots, a Whitechapel cap and a bottle of whisky; the masculine woman with a tartan plaid dress, golf brogues, a "boater" and glare glasses. Well, you will soon recover your self-respect if you spend the long entr'actes in the loggia, and take note of the opera-going kits worn by the indigenous inhabitants. They are fearful and wonderful to behold—particularly those of the women.

As regards the curative effect of these interminable intervals—at Covent Garden you pay a guinea and upwards for the class of seat which, on the Continent, costs five or six shillings only; but in the former case you obtain a fairly comfortable armchair, whereas, in the latter, you have to put up with a straight-backed seat which seems to be padded with sawdust under pressure. You may even be relegated to a cane-bottomed stool with no back at all. This calls for considerable endurance and fortitude over a period of, say, five hours.

In theatre furnishing, the British key-note is reasonable comfort: the Continental is strength.

The long intervals, then, afford you time to repair tissue waste at the buffet, and to walk off your aches and pains.

All Continental opera houses should be provided with Massage and Anti-Cramp Salons.

Back to the National Theatre for *The Kiss*, a light opera by Bohemia's favourite composer, Frederik Smetana.

Smetana was born in 1824, and died in Prague in 1884. His luck was consistently out, he lived in acute and perpetual poverty, and he ended his days in a lunatic asylum. Now that he is well out of the way, his music receives widespread recognition—a trick the Fates play on many creative artists.

Smetana's compositions are full of national airs, folk songs and dances. They are brimful of good cheer, simplicity and patriotism. *The Kiss* is a charming example: all melody and sunshine.

IV.

A day's journey south-westwards, in the long axis of Czecho-Slovakia, carried us into attenuated Austria and landed us at Vienna.

The scenery on the way was varied and interesting. Snow, often many feet deep, covered the whole countryside.

At the frontier the Teutonic touch was once more in evidence: nobody bothered about passports and dutiable articles, and everybody seemed pleased to welcome the "Englischers."

Grieben's guidebook dealing with Vienna divides the hotels into the following classes: "palatial," "first-class," "good and comfortable," and "for simpler requirements." We went to the Regina, one of the first-class. This hotel is in an excellent and convenient situation, the rooms

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are very good, the food—on English standards—is fair, and the charges are moderate.

Vienna is described with vision and sympathy by Lord Frederick Hamilton in his "Yesterdays" series of books; but, so far as I am concerned, any adequate description of this beautiful city is an impossible task. Unfortunately Georgina went down for five days with influenza, which was then raging in Central Europe. However, her attack was a mild one, and she insisted that I should enjoy a maximum amount of off-duty. This was not an unmixed blessing by any means: not all enjoyment by a long way, for I saw far more of Vienna than I would, had Georgina been fit and well. In the evenings I used to return to the Regina more tired, physically and mentally, than I cared to admit.

This is an extremely common, but none the less asinine, method of spending a holiday.

A description—even an abbreviated one—of what I saw would fill a fair-sized book. Add another volume for impressions, still another for comments, and you have a three-decker saga.

No.

It will never be written.

It would never be read.

Let's away to the opera.

The Vienna State Opera House is only rivalled by the opera houses in Berlin and Dresden. However, in spite of strenuous endeavours, it is now finding it difficult to keep up the pace. Dr. Richard Strauss' presence is a great asset, but it has to be paid for, and heavily. The salaries of the numerous "stars," singers and dancers, are not based on the scale of fees which these eminent personages receive during their flying visits to Covent Garden, or to the Metropolitan Opera House, New York; still, they are formidable. Then there is a big and very efficient orchestra to be subsidized, together with the chorus, the ballet, an army of directors, artists, supers, attendants and so forth.

But post-War Austria is a small and impoverished State, while, for several years past, Vienna itself has been run by a Socialist municipality. The administrative and financial methods of this body are said to be guided more by good intentions than by experience or skill, and it is feared that the opera house will be one of the first institutions to suffer, as soon as it found necessary to wield the economy axe in earnest.

However, there were no signs of impoverishment or economy when the ballet, *Joseph's Story*, was staged.

Magnificent scenery depicting the riches and opulence of a visionary East. Beautiful lighting effects. Georgeous dresses—where dresses were worn. The Ethiopian slaves were practically nude; and, as the action progressed, most of the ladies discarded everything except one or two insignificant, albeit costly, girdles. As I gazed at them, and remem-

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bered the raging snow storm without, I marvelled at the wondrous works of Man—central heating plants for instance. Joseph, as befitted the part, was distinctly modest. He wore the skin of a kid—a small one—in the daytime, at any rate.

Above all else, Strauss' contribution: the music. That was a product of genius, defying description. So there we must leave it in the hope that you, some day, will go to Vienna to listen and to be enchanted beyond the limits of wildest imagination's flights.

As for the particular incident in Joseph's career depicted in this ballet —well—

Perhaps I should explain.

I am a very senior major.

From this it will be realized at once that I am no chicken.

In the course of a long lifetime I have seen a thing or two—naturally.

But *Joseph's Story* was a complete surprise. It astonished me beyond words. It consisted of a graphic representation of the thirty-ninth chapter of Genesis. The representation was artistic and faithful: nothing was omitted: much was elaborated. The audience numbered 2,318 souls: most of them, in this stronghold of Roman Catholicism, being Christians —presumably. They took it very well. I have seen more emotion displayed at a performance of *Uncle Tom's Cabin*. Of course, Joseph was a remarkable man; but if Mrs. Potiphar possessed a quarter of the art, grace and loveliness of Austria's première danseuse, then the said Joseph was even more remarkable than his most fervent admirers realize.

Georgina had not recovered sufficiently to accompany me. Seldom can it be said that influenza is a blessing in disguise.

The Lord Chamberlain's Department will see to it that *Joseph's Story* does not appear in this country in its Viennese form.

There followed another Strauss ballet, in honour of a famous Viennese delicacy which is largely composed of whipped cream.

This was a dainty, whimsical production. The music was delightful and, once again, the staging was excellent.

The freshness and innocence of this ballet came as a welcome relief after the terrible turmoil created by poor General Potiphar's impossible wife.

On returning to the hotel that night I was greeted with: "Well old boy, had a good time?"

"Yes, thank you: topping."

"What did you see?"

"Oh! See? Why—whipped cream and chocolates and crystallized fruits and gorgeous scenery and lovely dresses and wonderful dancing *and* marvellous music—divine—and—"

"Good."

A pause.

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"But tell me—what has whipped cream to do with Joseph?"

"Oh! Joseph? To be sure. I had forgotten about Joseph. Well, you see—Joseph—I can't tell you about the music it was great and the dancing too and oh the superb scenery and costumes and things and Joseph and all that—"

"Delightful, I'm sure."

A pause.

"But what on earth was it all about? You have not told me anything, really."

"Oh! That? Well I'm sure *I* don't know. How should I? What would it be all about? Joseph, of course."

A pause.

"Do you know—I don't believe you were there at all."

"But I was. I swear it. You understand—a Potiphar woman and all that, only Joseph he——"

"Have you booked seats for to-morrow?"

"No: I was not sure you would be well enough to go."

"Book them, please. *I have every intention of going to the opera to-morrow.*"

Now—what did Georgina mean by that?

Once upon a time Wagner unbent, and delighted his public with the good-humoured *Master Singers of Nuremberg.*

Years after—in 1911—at Dresden, Strauss followed suit and scored a similar success with his *Cavalier of the Rose.*

Strauss is a Bavarian, born in Munich in 1864. He became Director of the opera in Wagner's birthplace, Leipzig, and later moved to Dresden in a like capacity. A long and brilliant directorship ended in differences of opinion and quarrels with the authorities, with the result that Vienna secured his services—or, if you prefer it, submitted to his dictatorship.

Vienna also provided him with a librettist, the romantic poet, Hugo von Hofmannsthal.

But Strauss is not a Viennese romanticist: he is a German realist. As a rule—in *Elektra* and *The Woman without a Shadow*, for example—Hofmannsthal's poetry is treated with merciless realism by a composer whose orchestral craftsmanship is quite uncanny. Strauss can be positively devilish in his ingenuity and skill. There are passages in the music of *Joseph's Story* which will give you a most unpleasant gooseskin—like the one produced by the whistle of a shell which has passed within about six inches of the top of your head.

There is nothing of this in *Cavalier of the Rose*: the score and the book form a particularly happy combination. The opera is fun and merriment from beginning to end; and the fascinating waltz tunes which are woven through it form a perfect feast of melody. Add to this the world-famous Herr Richard Mayr in the part of "Baron Ochs," and you will spend an evening which will remain with you, a delightful memory, for all time.

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The next opera was Halévy's *The Jewess.*

If this had been presented after the manner of *Norma*, in Prague, it would have been equally childish and disappointing; but in Vienna—as in Dresden—only the best is good enough, and so *The Jewess*, despite her age, appeared in the splendour and solemnity which the words and music demand. Pomp and circumstance moved in the shadow of the valley of death. Illusion was created, and sustained: the piece marched with measured, funereal tread to its inevitable, tragic end.

A fine performance.

In the realm of opera *Tristan and Isolde* occupies the same place as *Romeo and Juliet* holds in the theatrical world: in their respective spheres, the finest love stories ever written.

It is often said that the music of *Tristan and Isolde* is difficult to understand: that it cannot be appreciated properly unless the listener is musically educated.

That may be so.

But after all, it is largely a matter of definition. Understanding, appreciation, education—what, precisely, do these terms indicate in a musical sense?

I do not know; and, what is more, I do not care, for the oftener I hear *Tristan and Isolde*, the more do I wish to hear it again, and again.

On the other hand, I neither understand, nor appreciate, "Get out and get under the Moon": there my education has been neglected, definitely.

While the outstanding feature of *Tristan and Isolde* is the beauty of its vocal and orchestral music, the charm of the opera is enhanced by certain adjuncts: the poignant tale, the picturesque costumes, the romantic setting by the sea. At the same time it must be admitted that, if pieces such as *Tristan and Isolde* and *Romeo and Juliet* are not just right all the way through, they suffer. They are too delicate to support the slightest defects —defects which would pass unnoticed or, at least, be forgiven, in more robust productions such as *The Flying Dutchman* or *Macbeth.*

Alas! even in Vienna the usual thing happened. Tristan was short, beefy, bull-necked, and in need of a shave. Isolde was tall, and voluminous, and her wig was like unto bleached tow.

When two such people engage in a passionate love scene, music, absorbing and divine as it may be, cannot altogether dispel a sense of the ludicrous.

On the stage a certain amount of inconsistency and improbability must be overlooked; but impossibility is a more dangerous defect, and, when it is due to human physical factors, it is apt to give rise to ridicule at most inopportune moments.

The plot of *Rigoletto* is about as harrowing as any plot on the operatic stage—and that is saying a deal; but the spectacle of Ceprano humping Gilda across the big Covent Garden stage was enough to make a cat laugh,

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as fat little Caruso was the weight-carrier and massive Madame Melba the load. With merciful consideration, the management dimmed all lights during the transit.

As regards Wagnerian opera, one can understand the inability of impresarios to effect an improvement: the vested interests of the recognized physical types are too strong for them. But are the playgoers equally helpless in the matter?

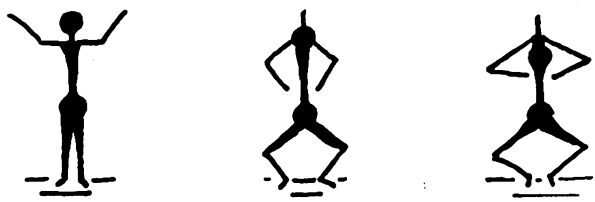
Yes: they are.

REGISTRATION OF FEELING (in three motions, by numbers.)

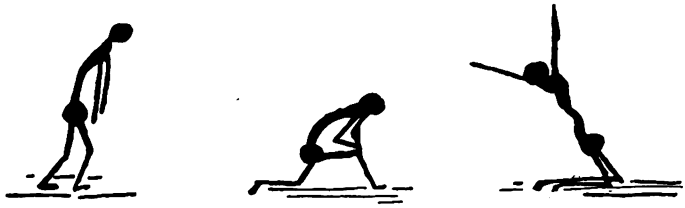
Elation, or love at first sight.



Disappointment, or "I'm not mentioned in the will, curse him."



Despair, or sentenced to the dungeons for life.



Standards are set in the Wagnerian Mecca, Bayreuth: here is what Mr. G. B. Shaw has to say:—

Those who go to Bayreuth never repent it, although the performances there are often far from delectable. The singing is sometimes tolerable, and sometimes abominable. Some of the singers are mere animated beer casks, too lazy and conceited to practise the self-control and physical training that is expected as a matter of course, from an acrobat, a jockey or a pugilist.

Another defect more noticeable in *Tristan and Isolde* than in any other opera, is what may be called Wagnerian Drill. The players seem to follow a traditional cult in the field of action. Love, hatred, hope, despair—each

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has its own peculiar mode of registration—and no other. Stuff your ears with wool, and look at the figure on the stage. If you are versed in Wagnerian lore you may safely bet that he or she is singing "I'll kill you," or "You are my own true love" as the case—i.e., the action—may be.

Imagine, if you can, the Mesdames Cooper, Arnaud, Baddeley and Thorndike all responding to the grand passion in the same rigid, sealed-pattern manner. And yet, that is what is done with poor Richard Wagner, now that he is dead and gone.

This curious phenomenon is here illustrated.

It is just as if a paragraph of K. R. were compiled after this fashion:—

ATTITUDES—OFFICERS'.

1. *Elation* (fig. 1).—To be adopted on attaining the age of 30—having been married at age 23.

2. *Disappointment* (fig. 2).--To be adopted on observing the omission of one's name from the half-yearly list of brevets.

3. *Despair* (fig. 3).—To be adopted on receiving the usual intimation that: "Officers serving in the hills do not require, and must not apply for, any leave."

Doubtless there is some such code in the German Army, as there is in German opera; but, to us, the idea is intolerable, and quite antagonistic to those original and individualistic modes of expression to which our Service messes owe much of their gaiety.

Rossini's *Barber of Seville* was rather disappointing. It was put on at the last moment, in place of another opera, the caste of which had succumbed to influenza.

The *Barber of Seville* is based on Beaumarchais' "Figaro," a character borrowed by several composers, notably Mozart. It is tuneful and spirited, and is remarkable for the fact that, although composed in the short space of two weeks, it is a finished piece of work. Still, it is not up to the standard of Rossini's other opera, *William Tell.*

Wagner's greatest work was *The Niblung's Ring*, comprising a prologue, *Rhine Gold*, and the triology *The Valkyrie, Siegfried* and *Night Falls on the Gods.*

These wonderful music dramas together make up an allegorical representation of Wagner's social creed. Regarded as operatic works they are great; but regarded as fairy, or daemonic, tales, they are meaningless. Therefore, before listening to what the composer has to say, seek an exposition of The Ring.

Fortunately, an admirable exposition is to hand in Mr. George Bernard Shaw's "The Perfect Wagnerite": an interesting, amusing and very instructive little book. Even if you are not a "high brow," it is well worth reading.

We had the good fortune to see *Rhine Gold* and *The Valkyrie* at Vienna

Wagner gave the producers of grand opera some exceedingly hard nuts

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to crack—so hard, that many of them remain intact to this day. In The Ring these nuts are more numerous, and harder, than in any of Wagner's other operas. But in Vienna we were privileged to see a marvellous piece of stage-craft: we saw a brand new production of *Rhine Gold* in which some of Wagner's most difficult conundrums were solved beyond any doubt.

The first scene represents the bed of the Rhine.

We saw the Rhine maidens singing and swimming under the surface of the waters. They did not merely move about in two, or at the most three, directions in spasmodic jerks, twelve inches at a time. That was all the poor scene shifters could manage in the old wire-and-pulley days. No: they floated, rolled, dived, somersaulted and darted here, there and everywhere, the embodiment of freedom, agility and grace. Real, live mermaids! And all the while the dwarf, Alberich, crawled crab-like over the rocky bottom. It was fascinating.

Then came an eerie scene: the subterranean cave of the Niblungs, very like the underground pictures in the Ufa film "Metropolis."

Finally, the crowning spectacle, the rainbow bridge leading to the palace on the heights of Walhalla: a fine picture.

Now, none of these scenes gave the impression of improbability. On the contrary, they were extraordinarily realistic. They must have cost much thought, labour, and money too. A revelation of what modern stage technique can achieve.

The Valkyrie formed a striking contrast, because it was presented in its old dressing.

In his day, in this opera, Wagner demanded the impossible of the producers; and this was evident in the performance we witnessed. But having seen the new *Rhine Gold*, one will think twice before saying that the seemingly-impossible will not be overcome in the modernized version of *The Valkyrie*—in Vienna at any rate.

As it was, however, the famous "Ride of the Valkyries" fell flat. The big orchestra accomplished wonders but, in doing so, it completely overpowered the somewhat inane Amazons. These luckless maids were quite incapable, vocally or physically, of shouldering their burdens. Worse still—Brünnhilde was an understudy (influenza again) with a gentle voice, the carriage and deportment of a mannequin and the physique of one who has lived a sedentary life on milk chocolate. Anyone less fitted to lead the Walhalla Alpine Club could not have been found.

But, after all, these are secondary considerations: the music alone of *The Niblung's Ring* will serve to cover a multitude of subsidiary defects, until money is forthcoming to obliterate them. For this, brains, artistic taste and technique already exist.

(*To be continued.*)

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OUR NEWEST CANTONMENT.

By Lieutenant-Colonel G. G. TABUTEAU, D.S.O.,
Royal Army Medical Corps.

For those who may be posted to Burma district a few notes on this the newest cantonment occupied by British troops may be of interest.

Most of the Corps know that such a place as Rangoon exists, but when they hear of Mingaladon they are apt to ask where is this place with the outlandish name?

For some years past the only places in Burma which have been garrisoned by the British and Indian troops have been Rangoon, Mandalay and Maymyo, Rangoon being the headquarters of the Rangoon Brigade area and Maymyo headquarters of Burma district.

When the troops were quartered in Rangoon they occupied old wooden barracks in the vicinity of the Shwe Dagong Pagoda, the Arsenal being actually inside the Pagoda.

The Shwe Dagong is one of the most conspicuous landmarks in the district, standing on the only high ground there is on the outskirts of the city of Rangoon. From its elevated position it commands the whole of the city and the river front.

It is surrounded by a moat, now empty, and a high loop-holed wall with gun emplacements at different points. These are now dismantled.

All these buildings have now been evacuated and the troops moved to the new cantonment.

The Pagoda, however, is still under military supervision, and all visitors to the inside of the Pagoda have to proceed barefooted; few English people care to do this, but it is no deterrent to our American cousins, who come in swarms. Military officers on duty can go booted and spurred. To some extent the Burmese have cut their own throats by making the barefoot rule so stringent. Their visitors constituted a large source of revenue. In other pagodas in Burma it is only necessary for visitors to remove their boots.

The evacuation of the Pagoda was completed last cold weather, the final stage being reached when with full military honours the bodies of three officers who had been killed in the war of 1856 and were buried within the precincts of the Pagoda were disinterred and reburied in the military cemetery. The funeral was of as representative a character as possible. Officers and other ranks of all units attended, also a naval detachment from H.M.S. "Emerald."

The building of the new cantonment was commenced in 1922, and it was eventually occupied in December, 1928.

Mingaladon is situated between the 12th and 14th mile on the main

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Rangoon-Prome road to the north of Rangoon. It stands on the further point of the small ridge known as the Eastern Yomas.

The highest point, 232 feet, is a knoll about one mile to the north-west crowned by the usual pagoda.

Most of the cantonment lies between 160-120 contours. The main Prome road forms a water-shed which drains on the south-west side into a small nullah which is dry from March until the middle of May.

On the north-eastern side it drains down to open paddy land with the railway as a cantonment boundary.

Communications.

The main Rangoon road is tar-macadamized up to 21st mile, after which it is chiefly constructed of red laterite. The only road out of Rangoon is that leading to Prome, 178 miles distant. There is quite a good surface all the way, and during this summer the road has been greatly improved by the replacing of many of the old wooden bridges by modern steel and concrete ones.

Prome used to be a very important town on the banks of Irrawaddy, but has lost a lot of its importance since the railway was built. At the 21st mile a road branches off to Pegu, 46 miles distant from Rangoon.

From there a new road is under construction to Mandalay and is due to be opened in 1931 or 1932.

The railway runs a frequent service of trains to the cantonment station which is a terminus. The journey to Rangoon takes about thirty-five minutes at a cost of 4 annas return for other ranks. First class, Rs. 1.8.

A car is a necessity, as Rangoon is the only place for shopping, gymkhana, clubs, etc.

The climate is essentially tropical in character, and being in the wet zone the rainfall during the rainy months is very heavy. The yearly average for Rangoon is about 118 inches, that for Mingaladon being nearly ten inches less. The coolest month of the year is February, when the night temperature drops down to between 58° and 64° F., the day temperature being 80° to 90° F. The hottest months are April and May. The maximum this year was 102° F.—this was considered unusually high—the minimum at the same time being 75° F. This does not appear high to those who have suffered from the heat of many Indian plain stations, but the wet bulb is only about 10° below the dry bulb, and consequently one is usually bathed in profuse perspiration after the slightest exertion, the redeeming feature being that the nights are always quite bearable, and from 5 p.m. a strong breeze gets up which renders walking and games quite pleasant. There is no such thing as a fire-place in either Rangoon or Mingaladon. The latter is usually 5° to 6° cooler than Rangoon. The rains for the past twelve years have broken on an average in the second week of May. Some years they have been as late as May 27. The first period is only a series of storms and heavy showers; the real monsoon

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setting in from the end of May, July and August gives the heaviest rainfall.

The rain continues up to end of October. The greatest difficulty is experienced in trying to keep clothes, blankets, etc., dry during this season.

To sum up, the seasons may be classified as hot, . . . hot, wet and . . . wet. Adjectives may be supplied according to taste.

Bungalows are all Government property, there being no privately-owned houses in the cantonment. They are of two types, classed as (*a*) senior married officers and (*b*) junior married officers, all put down as four-units accommodation.

This is an important point, as majors and lieutenant-colonels, being entitled to five and six units respectively, are eligible for a refund on their lodging allowance as they only occupy four units.

In point of fact the two types of bungalows have exactly the same number of rooms, some of those in the larger type being actually smaller, the main difference being that the senior married class house boasts of a more pretentious exterior and has a somewhat larger hall, drawing-room and dining-room, also two extra servants' go-downs. Garage and stabling are provided in all compounds.

The bungalows are built of brick with red-tiled roofs, and have red tiled floors downstairs and polished teak floors and staircase upstairs.

Electric lights and fans are in all bungalows. There are also English baths and a water-borne sewage system. Two baths and lavatories upstairs and a wash-basin downstairs. At present the compounds are very bare, but after a few years of occupation should be quite pretty.

It is a pity most of the larger trees were felled during the building of the cantonment.

The Garrison consists of one battalion British Infantry, less one company stationed in Rangoon, and one company on detachment at Port Blair, in the Andamans, which is an Indian penal convict settlement.

One battalion of the Indian infantry, less one company in Rangoon.

A large Arsenal with a strength of four officers and 234 men. Total garrison strength: British Infantry, 656; Indian Infantry, 600; I.A.O. Corps, 234; Followers and servants, &c., 1,333. Total population about 2,823.

The sick of the companies of the British and Indian infantry stationed in Rangoon are received as direct admissions to the hospital at Mingaladon from a combined detention hospital.

The hospital is a combined British and Indian hospital, and since April 1 of this year has been classed as a second-class hospital, thus carrying charge allowance at the rate of Rs. 180 per month.

I think it is the only one of its kind in India. The usual combination being an Indian military hospital commanded by a senior I.M.S. officer with a British wing commanded by a junior R.A.M.C. officer. Here it is exactly the reverse.

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The hospital is a well-built two-storied brick building, British wing on the south side, Indian wing on the north, the two sections being joined by the administrative block which contains the usual offices facing east, and behind storekeepers' offices and stores. There is a certain amount of unavoidable duplication of offices and stores for the two separate wings. In between are two blocks containing the Brigade laboratory, and another the operating theatre for the British wing, X-ray room and clinical side room. The X-ray room has not yet been fitted out, but a very complete outfit has been sanctioned by Army Headquarters, and it is hoped the apparatus will be installed within the next couple of months.

The family hospital is connected with the main building by a covered verandah.

Dermatological patients are accommodated in a barrack block belonging to the British Infantry company, who are on detachment in the Adamans. This block is just across the road from the main hospital.

Originally what is now the officers' ward was built for these patients, and the officers' ward was a single-storey block next the family hospital.

This arrangement was found to be most unsuitable and the intended officers' block is now the medical stores, and officers are accommodated in the ward which was designed as the dermatological centre and which is really the best portion of the hospital.

It is intended at some early date, when funds become available, to build a separate block in the hospital compound for a dermatological centre, thus making the hospital a self-contained entity.

In the year 1929 one had hoped to find a reduction in office correspondence, but after an experience of three Indian tours this appears to increase rather than to decrease. In time it should reach the zenith of the Indian clerk's ambition, that is, to "Acknowledge an acknowledgment" and so *ad infinitum*.

Personnel consists of: Officers, British wing, 4 (includes one in Rangoon); Assistant-Surgeons, 4 (includes one in Rangoon); Sisters, 4 plus 1 Indian trained lady in family hospital; R.A.M.C., 1 serjeant or corporal and 7 other ranks; Regimental Nursing Orderlies, as required; Indian Hospital Corps, 57.

Indian wing: I.M.S. Officers, 2, one of whom is in charge of Brigade Laboratory in Rangoon; Indian Officers, 3, one of whom is employed in Brigade Laboratory in Rangoon; Warrant Officers, 1; Indian Hospital Corps, 27.

Accommodation.—Hospital accommodation is as follows:—

British wing, 70 beds; Indian wing, 60 beds. Total 130 beds.

British wing is made up as follows: Officers, 4; women and children, 6; isolation, 4; other ranks, 56. Total 70.

Indian wing: Indian Officers, 2; isolation, 4; other ranks, 54. Total 60.

Transport.—Two Fiat ambulances, to be increased later to three. One is permanently stationed in Rangoon.

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Disease Incidence.—It is too soon to predict how our returns for the year 1929 in Mingaladon will compare with those for 1928 in Rangoon, but everything up to now points to a considerable improvement. Rangoon showed a very high incidence of dengue. This it is hoped will not be so bad in Mingaladon.

Rangoon had the unenviable record of showing the highest figure for venereal in India. The returns for 1927 showing a ratio of 219 per 1,000 compared with 56·8 for all India. No marked decrease can be expected for two reasons, viz., (1) there being one company permanently stationed in Rangoon, and (2) the cheap and easy accessibility to Rangoon, 4 annas return for the soldiers. If it were not for what is statistically known as minor septic diseases the sick ratio would be very small. A large number of this type of case, both in hospital and attending, is the direct outcome of climate. During the hot period I have seen some of the worst cases of "prickly heat" I have ever come across; even the mild cases lead to boils, septic sores, ulcers, etc.

Owing to the continual moist atmosphere and consequent excessive sweating, even the slightest abrasions are slow in healing.

One recognizes the fact that troops are quartered in various stations throughout India for one of three reasons: (1) It has strategical advantages, or (2) is good training ground, or (3) is a healthy station.

Let us hope that Mingaladon will at least qualify for (3). It is hard to see its claim for (1) or (2).

Water supply is from two tube wells situated 1½ miles west of the station, from which the water is pumped to a reservoir tank placed at the highest point of the cantonment. This tank has a capacity of 150,000 gallons; during the hot weather the daily consumption reached 450,000 gallons. Up till quite recently the water gave an excellent bacteriological analysis, but lately it has come under grave suspicion. The cause apparently is faulty construction of the concrete sumps. Work on these is nearly completed, and then the supply should again be above suspicion.

Up to the present time officers serving in Mingaladon continue to draw Rangoon allowance at the rate of Rs. 150 per month to compensate for the extra cost of living.

Servants are much more difficult to get and demand a higher wage for coming out here, where they are away from the bazaars of Rangoon.

One of the rewards for serving in Burma is that officers are entitled to three months' privilege leave instead of the customary two.

It is not always easy to take full advantage of this extra month, owing to an unwritten rule that not more than one officer is supposed to be on leave to the United Kingdom at one time. Owing to relatively small numbers, scattered stations and unavoidable casualties, sickness, etc., R.A.M.C. officers are not in a position to avail themselves of this privilege with any regularity. A battalion may be able to allow its officers to take full advantage of the rule.

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When you are asked what you do in Mingaladon, the answer is "Nothing." There is no club. There are four tennis courts, one in each mess compound, i.e., the British Infantry, Indian Infantry, Sisters' Mess, and G.O.C.'s compound, none of which appears likely to wear out from over use, as they are unplayable for six months in the year, i.e., during the rainy season.

There is fair snipe shooting to be had in the early season, from the end of August to the end of October. Within driving radius, later on, from January to March, a certain amount of jungle fowl shooting can be got. There is no fishing.

Mingaladon is a very pleasant country residence, in many respects preferable to Rangoon. Cooler by 5° to 6° in the hot weather and with a rainfall of nearly 10 inches less. For those who like a quiet life it is ideal. There are very pleasant country walks, and within two miles of Mingaladon there is a golf course, eighteen holes, which is one of the best out East. Rangoon is within half an hour's drive, where there are the Pegu and gymkhana clubs, two golf clubs, turf club, boat club, country club, swimming club, and the usual selection of picture houses.

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Clinical and other Notes.

A CASE OF *BRUCELLA ABORTUS* INFECTION.

By Major F. C. K. AUSTIN,
Royal Army Medical Corps.

Recent work in America has definitely shown that infection from the organism known as the *Brucella abortus* Bang, the cause of contagious abortion in cattle, occurs in human beings. Whilst carrying out studies at the London School of Hygiene and Tropical Medicine, Endsleigh Gardens, it was made abundantly clear in the lectures of Drs. Manson-Bahr and Duncan that this work was being followed up in this country, and already several authentic cases of the infection have since been reported in England.

During the month of July, 1929, I was asked by Lieutenant-Colonel W. Davis, R.A.M.C., to investigate a case of obscure fever in a female patient. The essential features are herein set forth :—

Previous History of the Case.

Mrs. R., aged 41, wife of a Warrant Officer, Class I. Three healthy children, ages 8, 7, and 4½ years. No miscarriages. Born in Scotland, where she lived until the year of her marriage 1914, coming to England with her husband the same year. Apart from the period 1920-1923, when she joined her husband at Cologne, she has never been out of this country, and has always enjoyed good health. She was accustomed to consume about one pint of raw milk daily and her children drank even larger quantities from the same supply.

The patient states that during the month of April this year, she was taken ill with fever of three weeks' duration, which ran a very similar course to her present illness. Influenza was very prevalent at that time and her condition was thought to have been of that nature, though the patient is convinced that her illness was unaccompanied by any catarrhal symptoms whatsoever. Furthermore, the headache which appeared almost at the onset was of a much greater severity than that of her present attack. She also had pains in the small of her back and shoulders then, which have not recurred on this occasion. The furring of her tongue also was more pronounced during the April attack.

The pyrexia then as now was that of an almost regular intermittent fever. Each afternoon about 2 p.m. she became aware of the fever, and at 6 p.m., when her temperature was recorded, it frequently reached 102° or 103° F. She usually slept from 10 p.m. until 3 a.m., when she awoke shivering and drenched with sweat of a distinctly disagreeable odour and requiring hot drinks, hot bottles and additional bedclothes to regain

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became troublesome, fever returned, and from this day was regularly recorded (see chart) and presented those features already mentioned.

I first saw the case after the pyrexia had continued for more than a week and was struck by the fact that the patient did not appear so ill as the height and the duration of the fever would seem to warrant, a point submitted by Kern as being of considerable clinical importance.

Physical Examination.

Apart from furring of the tongue, slight puffiness of both ankles and a certain pallor, there was little alteration from the normal. The patient had been edentulous for years, nevertheless to avoid overlooking any possible source of local sepsis radiological examination of the upper and the lower jaw was carried out. A small portion of a right upper molar tooth was revealed and this was removed by the dental surgeon without any alteration in the course of the illness.

She had no cough and both lungs were quite healthy; sputum was obtained with difficulty and found negative to tubercle, and X-ray examination of the chest showed no radiological abnormality. The heart sounds were normal and pulse-rate was not out of proportion to the fever. Neither spleen nor liver was palpable and there was no lymphatic glandular enlargement. Examination of the urine showed no abnormal constituents present.

Examination of the blood on July 9, 1929, gave the following results: Total red blood-cells 6,000,000 per cubic millimetre, hæmoglobin 75 per cent, colour-index 0·7 per cent; total white blood-cells 4,200 per cubic millimetre.

Differential blood-count: Polymorphonuclears 52·2 per cent, small lymphocytes 28·0 per cent, large lymphocytes 16·0 per cent, transitionals 3·25 per cent, basophils 0·25 per cent.

The blood-count showed a leucopenia with relative lymphocytosis compatible with an *abortus* infection.

July 11, 1929.—Patient's serum was negative in all dilutions to *B. typhosus*, para A, para B, para C, and *B. gaertner*.

July 12.—Blood-culture proved sterile.

July 18.—Catheter specimen of the urine showed no *B. coli*.

July 25.—Vaginal and uterine swabs showed a few staphylococci, probably due to contamination.

July 31.—Patient's serum was positive to the *Brucella abortus* in a dilution of 1 in 500. Specimens of serum were sent to the Royal Army Medical College, where they were subjected to the absorption test by Major J. B. A. Wigmore, R.A.M.C., who reported that absorption with *Br. abortus* removed all agglutinins for both abortus and melitensis, whereas, after absorption with *Br. melitensis* the serum still agglutinated *abortus* in a dilution of 1 in 500.

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Diagnosis and Differential Diagnosis.

Remarkable as is the similarity which exists between the *M. melitensis* and *B. abortus*, morphologically, culturally, and serologically, so also is the train of symptoms to which they give rise in human infection. The pyrexia, however, in abortus fever is almost regularly intermittent in type, in contradistinction to the characteristic febris undulans of a melitensis infection, and the association with night sweats suggests a diagnosis of tuberculosis for which it may be mistaken.

Consideration must also be given to other diseases which bear a close similarity such as *B. coli* infection, leukæmias, pernicious anæmia, subacute bacterial endocarditis and Hodgkin's disease.

In the absence of any typical clinical picture the golden rule to be observed in dealing with such a case of prolonged pyrexia of unknown origin which has baffled every familiar explanation is to think of abortus fever as a possible solution to the problem.

Conclusion.

This case is only the ninth to be reported in this country. It bears a close resemblance to the one described recently by Davies and Campbell-Anderson. Other cases have been reported by Manson-Bahr, Bamforth, Wordley, and Thompson.

So far in this case, as in those previously mentioned, absolute proof by isolation of the infecting organism is lacking. It is conceivable that the attempt to isolate the organism may have failed because the blood was not withdrawn at the height of the fever. This explanation seems feasible in light of the similarity which exists between *M. melitensis* and *Br. abortus* already alluded to. Manson-Bahr, speaking of the former, writes, "Unfortunately, as the bacterium occurs only sparsely in the general circulation (unless in the earlier stages when the temperature is high), to search for it in the blood in the later stages of the disease does not aid in diagnosis."

The serological test was, however, positive in high dilution and no other source of infection could be located.

I feel confident that the April attack was identical with the present one, and that the period April 20, when it subsided, to approximately June 20, when fever recurred, must be accepted as an ordinary apyrexial interval, whether absolute or relative is difficult to decide. The duration of the present fever has already reached six weeks and it has not, as may be seen by the chart, completely subsided.

I am much indebted to Major A. S. M. Winder, M.B., R.A.M.C., D.A.D.P., who carried out the pathological investigations, and to the A.D.M.S., Home Counties Area (East), for permission to publish the case.

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A CASE OF SPONTANEOUS SUBDURAL HÆMORRHAGE.

BY MAJOR T. F. KENNEDY, O.B.E.,
Royal Army Medical Corps.

THE following case is recorded, as it presents many features of a most unusual character :—

A Lance-Bombardier, aged 38, of splendid physique, was admitted to hospital on March 20, 1929, having been detained for two days, complaining of abdominal discomfort with vomiting and diarrhœa. He gave a history of having had similar symptoms about a week previously, which had got better. He attributed the return of his symptoms to a party which he had attended the night before he was detained. His medical history sheet showed no entry for previous abdominal complaint.

On examination, nothing abnormal was noted in his abdominal cavity ; nothing abnormal was found in his urine. A little mucus, but no blood, was present in his stools. Nothing abnormal was noted in his nervous, circulatory, or respiratory systems. He was treated with magnesium sulphate, one drachm two hourly, and put on fluid diet.

His symptoms continued for four days without much amelioration, but then showed an improvement. His stools proved negative to both enteric and dysentery groups. On the night of March 24 he became very restless, and it was noted that his speech was affected. He was given potassium bromide, 15 grains, without effect. On examination the next morning the following condition was found. Stammering speech, nystagmus in both eyes ; pupils equal but reacting to light and accommodation ; no headache ; slight twitching of muscles of face ; inco-ordination of muscles of upper extremities but no apparent loss of muscular power ; no paralysis ; twitching of muscles of extremities ; deep reflexes increased ; Babinski's sign absent ; ankle clonus absent ; tache cérébrale present ; urine loaded with albumin ; systolic blood-pressure 140 mm. of Hg. Lumbar puncture was performed, the fluid drawn off was at normal pressure and of normal appearance. Laboratory report on the fluid showed the absence of sugar and globulin, the cell-count was 1·1 per cubic millimetre. The fluid gave

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a negative Wassermann reaction. There is no record of a specific history in the case. Patient got more and more restless throughout March 25, and, about 4.30 p.m., became violently delirious and had to be forcibly kept in bed; he became incontinent of urine and fæces, and his speech got inarticulate. It was then thought that he was suffering from uræmia. This condition continued throughout the evening and night with a few short intermissions, the longest of which was twenty minutes. At 4.30 a.m. on March 26 he sank into a comatose condition with cerebral breathing of Cheyne-Stokes rhythm; his pupils were dilated and equal in size. He remained in this comatose state up to about 1.15 p.m. on March 26, when he had a final convulsive fit in which he died.

A post-mortem examination was carried out by Major J. S. K. Boyd, R.A.M.C., D.A.D.P., Madras District. His report is as follows :—

"The body is that of a well-nourished man. There is considerable post-mortem staining, and some bruises are present on the right shoulder and wrist.

"*Thorax.*—The lungs are fixed to the parietal pleuræ by old adhesions. The left lung is bound down in this way throughout its whole extent, the right lung posteriorly. On section both lungs appear normal.

"The heart is covered with fat but the musculature is not affected. The wall of the left ventricle is somewhat hypertrophied, otherwise there are no abnormalities. The valves are free from vegetations and there is no atheroma of the aorta.

"The mediastinum shows nothing abnormal.

"*Abdomen.*—The stomach is in a contracted condition. Neither stomach nor intestines show any abnormality. The pancreas weighs 4 ounces and feels very hard. It was encased in very dense connective tissue and firmly bound to the duodenum and posterior abdominal wall. The lobulation is unduly marked. No fat necrosis could be seen. A chain of small hardened glands extends from the head of the pancreas along the vertebral border.

"*Spleen.*—Weighs 5 ounces. Normal in appearance and on section.

"*Liver.*—Weighs 66 ounces. Normal in appearance and on section.

"*Kidneys.*—Each weighs 8 ounces. They are large, rather irregular in shape, paler than normal and show a very slight mottling. The capsule strips readily.

"*Suprarenal Glands.*—Appear normal in every way.

"*Bladder.*—Distended with urine.

"*Skull.*—No evidence of injury. A large subdural hæmorrhage was found covering the complete parietofrontal aspect of the right cerebral hemisphere. This has exerted considerable pressure on the brain which is seen to be flattened.

"The hæmorrhage does not extend to the base of the brain. The bleeding point seems to have been a small vessel on the surface of the piarachnoid membrane.

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"There is no hæmorrhage into the substance of the brain, and the vessels of the circle of Willis are normal.

"There is no injury to the base of the skull.

"Portions of pancreas, gland, kidney and brain taken for section,

Results of Microscopical Examination.

"*Pancreas.*—There is an increase of young fibrous tissue surrounding the acini. The secretory cells and the islets of Langerhans appear normal.

"*Gland.*—Shows slight chronic lymphadenitis. Otherwise it is normal.

"*Kidney.*—The glomeruli show congestion of the capillary tuft, but there is no exudate into Bowman's capsule and no proliferation of the epithelium of the capsule.

"The secretory tubules show some granular degeneration and desquamation of epithelium. There is no increase of interstitial tissue; blood-vessels are normal.

"These changes are sufficient to account for the albuminuria which was present. They are, however, of a recent nature, and not in any way suggestive of nephritic condition giving rise to uræmia.

"*Brain.*—Sections were cut through a portion of the cortex which showed on the surface some adhesion of the clot.

"The vessels in the brain substance are markedly congested. There are early degenerative changes in the brain tissue immediately underneath the clot. The clot itself shows pigmentary changes suggesting that it is of some days' standing.

"*Conclusions.*—The cause of the patient's illness and death was cerebral hæmorrhage. This hæmorrhage is of an unusual type, and its causation is obscure."

Conclusion.

I think that there is little doubt that the cause of death was the subdural hæmorrhage which was of several days' standing, as shown by the fact that certain pigmentary changes had taken place in the blood-clot. The absence of any history of fall or injury, any lesion of the skull, specific history, high blood-pressure or an atheromatous condition of the blood-vessels would point to it being one of those spontaneous hæmorrhages of obscure origin.

It is extraordinary that a hæmorrhage of this magnitude could have been present for days without giving rise to that train of symptoms which is usually associated with such a condition.

I have to thank Lieutenant-Colonel E. Bennett, R.A.M.C., for kind permission to publish this case.

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Sport.

AN ELEPHANT SHOOT IN SOUTHERN INDIA.

By Major F. S. GILLESPIE,
Royal Army Medical Corps.

Just before Christmas, 1928, I received a letter from an old friend, R. C. M., a coffee planter in the Billagirirangan Hills, a well-known shikari, and one of the most hospitable and unselfish fellows that ever stepped. The gist of the letter was this: "Would you and Colonel T. care to join me in February on a trip after 'rogue' elephants in the Baragur Hills?" Needless to say the invitation was accepted with alacrity! The leave question was fairly simple; I was temporarily my own boss, and there was not much fear of O.C. Station turning it down, as that responsible position was filled by Colonel T.

The next important question was rifles suitable for shooting elephant. I have the greatest respect for the African hunter who tackles his beast with a ·256 Mannlicher, or something not much bigger, but being neither a good shot nor an experienced hunter, I have not the slightest desire to emulate his performances. Colonel T. had no difficulty, for his "Mess" owned a double hammerless ·577 cordite rifle, and when I mentioned my prospective trip to a Sapper Major, who was a patient of mine at the time, and a keen shikari, he most generously offered to lend me his rifle, a double hammerless cordite ·450 No. 2 by Jeffery, a weapon quite powerful enough for any game. I was particularly pleased with the loan as I knew it was a duplicate of the rifle R. C. M. used, and there would therefore be no difficulty in securing ammunition for it, rather a problem in the case of a ·450 in India.

We fixed our leave to start on February 4, as the 3rd being a Sunday would allow us to get a flying start to R. C. M.'s estate. Our journey was uneventful, except for the bumping of a water buffalo which suddenly elected to swing its hind-quarters into us as we were passing it at about thirty miles an hour. The luggage carrier on the running board was somewhat bent and the petrol can badly damaged, but the buffalo seemed little the worse.

Next morning most of our kit was loaded up on a Ford van, and we and the remainder of our kit were packed into a Chevrolet and started on our trip of almost fifty miles to our headquarters in the Baragur Hills. Fifty miles does not sound very far, but the roads over which we travelled would better be imagined than described! One part had never been traversed by a car before R. C. M. did it in a previous trip after elephant in 1926, in which expedition he and his companions got three "rogues" in two days. One of

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the elephants was killed by R. C. M. at about five yards range, when it was charging the party. Its tusks after it fell were found to be only six feet from where he was standing when he fired.

To return to the road; when we arrived at Kowdally we were met by some of the trackers who had preceded us, and were told that we might get the car along the next ten miles of road, though no motor had ever done it before, but the last five miles up the hill to Sengady was quite impracticable, as the hair-pin turns were much too sharp. We therefore engaged ten pack bulls to go to the bottom of the hill to be ready to take our kit. Having done this we pushed on and arrived at the tenth milestone without mishap. Not so the Ford; about five miles from the bottom of the hill the bolts holding the spokes into the hub of one of the back wheels sheared and the wheel simply disintegrated. By the time the news of this catastrophe reached us it was nearly dark, and we had to face the job of unloading the Ford and getting the contents on to the pack bulls. This and the lifting of the Ford off the road took a considerable time and we had a much-needed meal on the roadside before we pushed on.

R. C. M. possesses the true pioneering spirit, and suggested trying to drive the last five miles up to the bungalow where we had decided to spend the night; as we were all pretty tired we agreed to anything that would save a walk. The "Chev." turned up trumps and manipulated the corners successfully; the road was not as bad as we had been led to believe, but there was very little margin of safety and the car wheels seemed perilously near the khud side. However, we eventually got to the outskirts of a village and called upon some of the inhabitants to guide us to the bungalow. It proved to be very poorly equipped and contained one table and a long chair; we tossed for the latter as a resting-place for the night and the Colonel won. R. C. M. and I had a cushion each from the car and my Burberry over our legs, but in spite of discomforts we were soon ready for sleep, the hour then being 1.30 a.m. As we settled down R. C. M. philosophically remarked that "he had noticed that a trip which started badly almost always turned out well."

Next morning we packed all our belongings on to the bulls and started for Punnachi, ten miles away, as a "rogue" there had been proscribed for killing a man and damaging crops. A slight digression may be necessary to explain the term "rogue." In most parts of India the shooting of elephants is absolutely forbidden except when they begin damaging crops and attacking or killing villagers. If an elephant starts on a career of crime the local inhabitants report the matter to the Forest Department; a description of the beast is given, usually the circumference of his fore-foot; the approximate length of his tusks and any marked peculiarities, such as a torn ear or a white mark on his head.

The Forest Ranger then reports the matter to his District Officer, who forwards it on to the Collector of the District. The elephant is then "proscribed" as a "rogue," his description is published in the local *Gazette*

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and a copy posted to anyone who may ask to be supplied with it, usually some keen shikari. The notification gives the locality in which the beast generally roams, and finishes with the information that he may be shot on condition that his tusks shall be surrendered to Government if required. As a rule this provision is not enforced, Government officials realizing that there are few people so public-spirited as to spend their time and money and to run the risks entailed in the pursuit of "rogues" if, when they are successful, they get no trophies beyond the feet and the tail.

Now to continue our travels. We reached Punnachi about 10 o'clock and lunched and awaited the arrival of Bomma, the head shikari, a cheery old Sholaga who had been at the death of many a tiger, bison and elephant, not to mention less lordly game. Bomma arrived about 5 p.m., very annoyed with the local men who had led him a fruitless dance after an elephant which they assured him was the "rogue," but which on closer inspection proved to be a different beast.

Next day we left the bungalow at 6 a.m. with our own shikaris and a bunch of the local men, and crossing a valley arrived at the slopes of a long hogs-back hill—Punnachi Betta. Most of the morning was spent in waiting at fixed points while the trackers scoured the jungle for traces of the "rogue." Eventually we got news that Bomma was following the tracks of two elephants, so we pushed on in the same direction and waited in a clearing. While there a man came up with the information that he had located the "rogue," but as we knew that the place where he had marked it down was close to where Bomma had come on the elephant of the previous evening, we thought it was probably the same beast, and refused to go after it till Bomma returned.

Presently I spotted a black object on the hill a couple of miles away and pointed it out, remarking that I thought it was a bison. R. C. M. had a good look at it and then said it was an elephant. We all concentrated on the spot and eventually made out six elephants feeding. We therefore sent a man off to Bomma to tell him that the elephants he was after were probably part of the herd, as they were going in the same direction. Shortly afterwards we heard some terrible trumpeting and crashing from the direction of the elephants, and I must say I feared that Bomma and his companions had got involved in a vulgar brawl with them. However, our messenger returned shortly afterwards with a broad grin on his face and described how one part of the herd feeding high up on the hillside had dislodged a boulder which had rolled down the hill into another part of the herd. Elephants are panicky beasts, and the result of a large piece of rock suddenly bouncing in amongst them set them charging in all directions.

As soon as Bomma appeared we started off to investigate the report of the local individual, who had now convinced Bomma that the elephant he was after was really the "rogue" and not the beast seen the previous evening.

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We soon found his tracks and eventually discovered him in the middle of a dense brake of bamboos on a steep slope. We waited a couple of hours, but he showed no signs of coming out. We could hear him feeding and the rumblings of his "innards," and were all keyed up and ready for him to appear. Suddenly all noises ceased, and after a pause we realized that a change of wind or the fact that one of the trackers had gone too far round and having given him our scent had made him move off with the amazing silence an elephant can achieve when so minded. We started after him and found that he had gone straight down the valley, so Bomma and M. followed him up for a couple of miles, leaving the Colonel and me and the rest of the party. Alas, by 5 p.m. they returned with the news that he appeared thoroughly scared and had evidently gone right away. We retreated rather disconsolately to the bungalow and our dinner, and M. proposed that as soon as we had finished our meal we should pack up and make for Talaibetta on the way to Madeswaranmalai, where another "rogue" had his headquarters.

We were ready to fall in with any proposal, and loaded the bulls up and left the bungalow at 9 p.m. for a ten-mile trek. The first half was not bad going over a forest road, but the second part of the way was a nightmare trip down a steep hillside with only a semblance of a track, and stones of all sorts and sizes to stumble over. The bulls were slow and we had to keep pace with them, as there were only a limited number of lanterns. Eventually we came to a saddle joining the two hills, the rest of the journey being up a steep paved path to the top of a hill as high as the one we had so laboriously descended. Here we had a late supper, unrolled our valises on our camp beds and lay down. It was 2.30 a.m. and M.'s last words were that we would have to be up early, as the next day was the monthly pilgrimage to the Madeswaranmalai temple.

We were roused at 5.30 and had breakfast in the cold grey dawn, and even at this early hour the pilgrims began to arrive before we had finished. However, we managed to keep them behind us by telling them of the extraordinary ferocity of the "rogue" who was known to wait on the roadside for stray pilgrims. Bomma had gone ahead while we were breakfasting and had got in touch with the local shikaris, and we were soon informed that we were in luck's way, as not only was the "rogue" we were after on the spot, but quite close by was another and easily recognized beast whose tusks crossed near the ends. He had come from his usual haunts eight or nine miles away about a week before.

I was fortunate in having won the toss for first shot, and we set off after the crossed tusker, having first been led on a wild goose chase by a village idiot who sported a fine pink shirt. He escorted us to a place where he assured us he had "heard some noises—even seen the elephant itself!" On investigation we found the noises were made by monkeys and there was no sign of any elephant.

Meanwhile, a more reliable guide turned up and said he had just come

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from where the beast was feeding and had left a man watching it. We soon arrived at the spot only to find that the elephant had moved off. Now the real business of the day began; the following of tracks barely perceptible to the uninitiated but evidently clearly visible to the Sholaga. I was ahead with the best tracker when he suddenly stopped and signalled to M. that he could hear the elephant just ahead. M. immediately signed to us to make a detour and get above him on the hill. A very good move it proved to be, for we had hardly done so before there was a trumpet of rage and a crash through the jungle and the elephant charged back just where we had stopped before making the detour.

We waited for some time on the alert quite expecting another charge, but none came and we found that he had moved off. Picking up his tracks, we followed for a mile or so only to be startled by another snort and crash, though this time he went away without attempting to charge us.

After some more tracking we came out on a paved pilgrim's path to the temple, and there met a Forest Watcher who told us that the elephant was in a thick brake of bamboos close by. Very soon we could hear him moving about, but the jungle was so thick that it was quite impossible to push our way into it with any chance of getting a shot. We waited for a couple of hours hoping he might come out, but he showed no signs of wanting to move and started feeding. We were just wondering what to do when the Forest Watcher appeared again and announced that he had found a place where we could crawl through the bushes to a rock overlooking the bamboos. This we did, and though we could see where the leaves were quivering we could not yet get a clear shot.

M. had a sudden inspiration which seemed the only solution to the problem. This was that the men should go round to a clearing at the other side of the brake, below the elephant, and make a noise and give him their wind, and so drive him up towards us, they being prepared to bolt up trees if he became nasty and tried to charge them.

This plan would have worked beautifully if they had gone exactly where they were told. Unfortunately they got the brute started off on a line about sixty or seventy yards below us, instead of making him come straight up a track which would have brought him within twenty yards of us. Certainly they were successful in moving him, and a crashing in the bushes was succeeded by a view of his immense head and the enormous bulk of his back.

It was a case of now or never, and though I could not see his eye, I took as careful aim as I could at the place which I judged to be midway between his eye and ear, and pulled the trigger. He stopped as if stunned. Then came the bark of M.'s rifle just by my ear. I fired my left barrel and M. did the same—the Colonel was too far round to get a shot. A mighty crash, and down went the "rogue"!

This was followed by a desperate noise of trumpeting and struggling

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among the bushes, and very soon we saw the elephant on his feet again and staggering off—the cover was much too thick for us to get in another shot. Only those who have had a similar experience can realize my disappointment, for I had always read that an elephant which is not killed outright by a head shot may go right away and seem none the worse, even if he has been floored.

We soon crossed the pilgrim's path again, and I should probably have appreciated the humorous sight which met my eyes if I had not been so bitterly disappointed. There before us on the road were strewed about broken chatties, pilgrims' staffs and miscellaneous clothing, while a huge blood-trail crossed the track, not a few drops, but a continuous succession of splashes the size of breakfast plates, while the trees where he had broken into the jungle again were covered with blood which must have been coming out like a fountain.

We sat down by the roadside to discuss the situation, and made short work of a couple of bottles of beer and some lunch. While we were so occupied some thoroughly shaken pilgrims arrived to retrieve their scattered belongings. Apparently about ten of them had been on the road when the "rogue" arrived trumpeting with rage. Only one of them laid claim to having actually seen the beast, and it was fortunate that none of them had got in his track when they bolted for cover.

At this moment a man turned up to tell us that the "rogue" had doubled back and crossed the road lower down, and shortly afterwards our trackers arrived to let us know that the "rogue" was not far away in a clump of bamboos on a nullah bank. He was breathing heavily and groaning, and evidently was very sick indeed. I began to brighten up after this and had hopes of bagging him after all.

We were soon at the place, and sure enough we could hear him in the bamboos groaning now and then. We got above him and tried to get close, but he winded us and lumbered off. We ran on parallel to the bamboos till we heard him cross the stream. We were preparing to follow when he turned and came for us; he had got our wind and was preparing to do battle. Fortunately for us he was not quite sure where we were, and stopped in the nullah bed with his trunk raised to scent us.

I had a rapid "right and left" at his head. M. fired at the same moment and then I ran back a few yards to reload. All was now silent, then I heard a shout from M., who was lower down the slope and cool as the proverbial cucumber.

"Come along, he is down." I could hardly believe it, but there he was right enough, his huge bulk on top of a little knoll with his head down the slope. I put in another shot for luck, but he was stone dead. My first shot had hit him in the bump at the base of his trunk and gone through into his tusk, while M.'s shot and my second had got him in the brain. It was suggested to me later that he might originally have been hit in the right eye, and this would account for the fact that he went in almost a

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complete circle from the place where he was first wounded to the place where he was eventually killed. Unfortunately he was lying on the side we had first fired at, so we never saw where the original shots had struck him. It would have been interesting to find where that huge fountain of blood had come from.



FIG. 1.—My elephant taken just after he was shot.

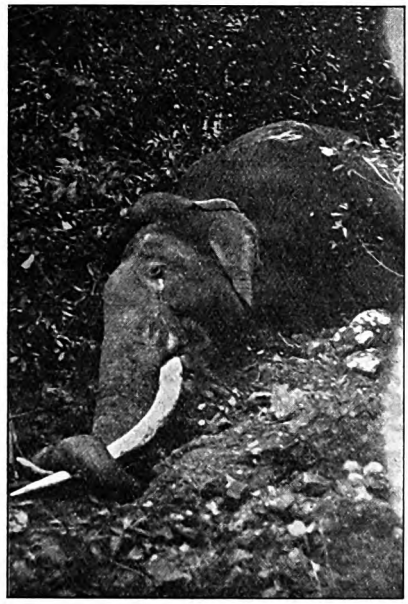


FIG. 2.—"Rogue" elephant shot by me. Note the tusks crossed at tips, a very rare occurrence.

He was a huge elephant, and his tusks which crossed at the points and were very massive measured five feet nine inches outside the gum and eighteen inches in circumference, the fore foot was about five feet one inch

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in circumference, but was unfortunately not measured till after it had been removed.

Shortly after this our camp arrived. We had been most fortunate over it, for M. had first decided to camp in a clump of trees by a spring, but later had sent a messenger to tell the men to come to a clearing near the nullah. The wounded elephant had gone slap through the middle of this clearing, and if our camp had arrived an hour earlier they would have most certainly been charged by him.

After a cup of tea and taking a number of photographs we went out to see if we could locate the other elephant, but had no luck; we heard a panther "sawing" in the distance and a troop of monkeys cursing him with great fluency! We retired early to bed under the stars to make up

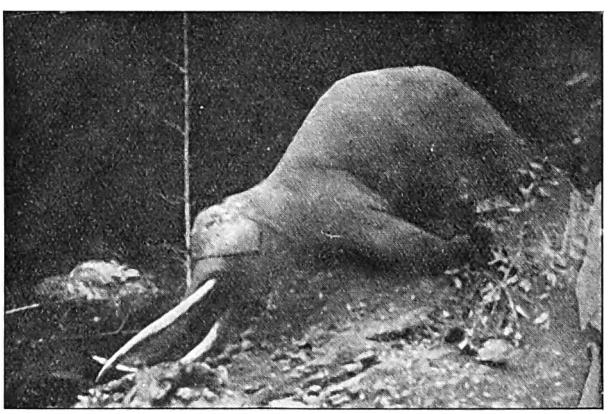


FIG. 3.—Photo taken early next morning. Compare position with reference to bamboo in other photo.

for our loss of sleep on the previous night. I was longer than usual dropping off and heard some animal moving about below by the nullah, but concluded it must be one of our pack bulls so took no further notice and went to sleep. In the morning we were told by the men that during the night the other "rogue" had been moving about by the dead one, and had pushed him to try and get him away. We found that the dead elephant had actually been moved about six feet.

Our trackers had gone out at dawn to try and locate the second "rogue" which was to be the Colonel's. They returned in a couple of hours to say they had met a man who had come up the valley and had seen the elephant which had charged him. We were soon on the move, and left instructions with the men with the pack bulls to get the kit moved to the bottom of the valley into which the elephant had disappeared. We went off by the most direct route down a steep gorge, and I remarked at the time that I was sure that when we got to the bottom we should find the brute had gone back!

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At the foot of the hills lay a dried up and barren plain covered with scrub jungle; there was very little shelter and it was extremely hot. We were very soon on to fresh tracks and followed them for a long way down the valley, only to be met by one of the trackers who told us that he had seen the elephant which had been joined by another, and it was not the "rogue." All the afternoon was spent on various tracks but there were no signs of the elephant; his morale had been badly shaken by the sounds of firing and also by the fact of coming on the dead elephant, and he had moved off several miles, evidently without any very definite purpose.

We returned to where our camp had been made in a river bed, though we had difficulty in getting any decent water, for it was green and uninviting. However, by digging in the sand close to a pool we succeeded in getting the water to filter through fairly clean.

After dinner the two head trackers came up very perturbed and said they had discovered the reason for our lack of success. The explanation was as follows: It was the custom with trackers when after elephant to go to the nearest temple and give the local deity a few annas and promise that if he produced the brute and it was slain, a sum of five rupees would be forthcoming. It appeared that when R. C. M. had last been in these hills he had run short of ready cash and had told the men to come to his estate, which they did, when he gave them what was owing, including five rupees for the god. This had been given to the pink-shirted man who had led us astray after the monkeys. On his return to the village he had said nothing about it and kept it for himself. The matter had only just been discovered by our men when they visited the temple.

Meanwhile, they had given the pink-shirted gentleman the five rupees for the god after the death of my elephant, and he had gone off with a tale about his wife being ill, and they were sure that he would spend the money on drink. They had therefore decided to follow him and retrieve the money, and make sure that this time it got to its right destination. They also proposed to make atonement to the god for the sins of the pink-shirted one.

At daybreak our sleep was disturbed by the noise of the atonement service. A youngster who had come with his father to learn the A B C of tracking was taken to a neighbouring pool, his head was smeared with cow dung, and he was stripped and immersed in the water which was green and slimy. At first he was loud in his protests but was assured that the whole success of the hunt depended on him, so he submitted to the ordeal.

After an early breakfast we split forces, sending trackers in various directions, and eventually at 2 o'clock one of our men returned with the very welcome news that he had traced the elephant and had left a companion to watch it. My prophecy had proved correct; the beast had gone right back up the gorge we had come down the previous day.

It was a long hot climb, but eventually we came on the watcher and he pointed out the elephant in a ravine at the other side of the gorge, but reported him very much on the alert and nervous of the slightest sound.

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We got above him as quickly as possible as it was getting late, and found a place on the steep hillside which was covered with loose stones and clumps of bamboos. We settled down to wait till he gave us a chance of seeing a vital spot to fire at; the sun was setting and we were anxious, as if matters were delayed too long we might not have light enough to shoot by.

The elephant was feeding in a clump of bamboos and there was a clear space about ten yards ahead of him but he seemed fixed for the day. At last a puff of wind gave him our scent, and up went his enormous head and he waved his trunk round seeking us, which gave us a fine view of the side of his head. The Colonel fired, and as his rifle went off I also fired, quickly followed by R. C. M., both barrels of his rifle going off together which sent him sprawling on his back.

The effect of this practically simultaneous discharge was absolutely devastating. The elephant just collapsed without a kick, and we were

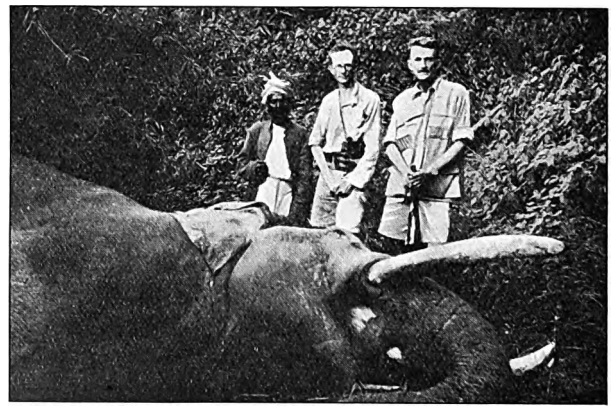


FIG. 4.—Col. T., R. C. M., and tracker, with Col. T.s elephant.

very soon down the intervening hillside to discover that he was a very fine trophy. Tusks measured later were 5 feet 8½ inches and 5 feet 9 inches, and weighed 55½ pounds and 58 pounds, a heavier-bodied elephant than mine.

I got a few photographs of him and his slayer and then we set off for camp, a long weary journey down the bed of the gorge, jumping from rock to rock and clambering down huge boulders. It was dark long before we got to the bottom, and we made torches of bamboo and grass which gave quite a good light but made things hot and uncomfortable as the gorge itself was very stuffy. Eventually we got to camp about 9 p.m., and were very ready for a drink and dinner.

We heard that shortly after we had left camp the Ponnachi villagers had sent an urgent call for us to come and deal with the "rogue" there. He had actually been in a field just beside their village eating their crops, and refused to leave in spite of the yelling of the crowd. We were early

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astir next day and packed up camp and made for Ponnachi, another long trek. At the top of the hill close to the village we sent a couple of men off for some green coconuts and had a most refreshing drink. We hung about most of the day waiting for the trackers to come in, and when they did at last arrive it was with the rather depressing news that the elephant had gone over the shoulder of Ponnachi Betta, a long hog's-back hill, the highest in the range. They also reported that he was in the valley beyond making for the river Cauvery, about ten miles off.

We pushed on to the Forest Bungalow and made out our plans for the next day. R. C. M. had a long confab with the trackers, and they came to the conclusion that the elephant had probably not gone as far as the Cauvery but was working round the hill, so we decided to go round the opposite way with the trackers above and below us on the chance of meeting him next morning.

We set off at 6 a.m., and had a rough trek round the south-west spur of the hill, and eventually got a fine view of the Cauvery away below us with the Mysore foothills beyond and a very dry and uninviting expanse of jungle between the base of the hill and the river. On our way we spotted a cow elephant with a baby calf, evidently only a few days old, and probably members of the herd we had seen before. We bore round to the north-east slopes and still saw no signs of our prospective victim, so we settled down for lunch at about 2 p.m., our first real halt since leaving camp that morning. Shortly afterwards we received a message from Bomma saying that we should go down the valley below us, as he was sure the elephant had gone down there. This move was not greeted with much enthusiasm, as it was a long way down a very steep hillside.

However, down we went and found when we got there that there was no sign of an elephant, and some cattle grazers assured us that he had not come that way. There was nothing to be done for it but to make for the top of the hill again, a climb of between 3,000 and 4,000 feet. The surface was very steep and covered with high grass, in many places above our heads. The loose stones rolled away under our feet and seemed to bring us down again as we tried to mount upwards, while every ridge we came to and hoped would be the top proved to have a still higher one beyond it.

At the summit at last a wonderful panorama rewarded our exertions—to the south-west and west the Billagirirangans with the Nilgiris beyond; to the north the Mysore Hills and east the Shevaroys and a couple of other little known ranges, while spreading away below us the smaller hills of the Baragurs. After enjoying this wonderful view we had to return to the sterner realities of life and the fact that we had at least eight miles to go to reach the bungalow.

We made the best pace we could down the further side of the hill, hoping to strike a path before darkness overtook us. Before we found the path we were forced to make torches of grass at the imminent peril of setting the hill side on fire. Later on we came upon a couple of pieces

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of dead bamboo which made excellent torches, and upon reaching the level of the bamboo jungle we had plenty of material for lights to see us on our weary way home.

We arrived at the bungalow about midnight after eighteen hours of fruitless tracking, for we never came within sight of the elephant.

Next morning we had to pack up and make for the estate, as our time was up. We had the same march to do as the night before I got my first elephant. It was a very different business in the daylight and did not take nearly so long. Instead of camping on the hill as before, we dropped down to the road below, where the "Chev." and the Ford, which had been repaired, were waiting for us, and also what was greatly appreciated, some beer sent out by Mrs. M. We also met the skinner who had been looking after the dead elephants; he had got the tusks, feet and tails, and there was great excitement over the measuring. We knew mine was a monster, but we were very keen to see how he compared with a couple of large South Indian elephants, of which R. C. M. had the measurements. We found the tusks were 8 feet 2 inches and 8 feet 2½ inches, which was bigger than any of the others recorded in Southern India. Later we had them weighed, and we found that they were also the heaviest recorded in Southern India, and within the first half-dozen of all Asiatic elephants—weighing 90½ and 91½ lb., a truly magnificent trophy!

We loaded up the Ford and "Chev." for our fifty-mile drive to the estate, but we chartered a bullock cart for the tusks; we did not dare put them in the Ford, as there was almost 300 lb. of ivory and it would have completely overloaded the van which had done so well over desperate roads.

The run back was uneventful, and we fairly revelled in hot baths and comfortable beds and the excellent food provided by our hostess. Next morning we found our cars awaiting us, and leaving one to take the tusks when they arrived, the Colonel and I set out for the Nilgiris, after the most strenuous and enjoyable eight days' shoot we had ever had. We were full of gratitude to our host, who had managed everything for us and given us an opportunity which falls to the lot of very few people in India nowadays.

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Echoes of the Past.

THE MEDICAL DEPARTMENT OF WELLINGTON'S ARMY, 1809-1814.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps.

The Medical Gentlemen.

Wellington commonly referred to the members of the civil department of the Army concerned with the care of the sick and wounded as the Medical Gentlemen. During the greater part of the eighteenth century the permanent medical establishment consisted for all practical purposes of the Regimental Surgeons and their Mates. Some of these were university graduates of good general education, but the majority, like so many of the country apothecaries who engaged in private practice, had no diplomas. The Surgeons, after satisfying the Surgeon-General of their abilities, received commissions, the Mates, who until the year 1796 ranked as Warrant Officers, were in much the position of apprentices.

All available evidence tends to show that the Regimental Surgeons as a whole were regarded as a meritorious and devoted body of men, and the regimental system was a popular one. Those who had entered as Mates, though their scientific attainments might not be of a high order, had at any rate great experience in dealing with the soldier both in peace and war. Unfortunately, neither the pay nor the prospects were such as to attract many of the most able men, and the more ambitious among the serving officers, having acquired skill and reputation, found it more profitable to set up in civil practice.

The General Medical Staff of the fixed hospitals, which appeared in war time, was provided by the appointment of Inspectors, Physicians, Staff Surgeons and Hospital Mates. Except for a short period during which John Hunter was Surgeon-General, the first three, which were comparatively lucrative appointments, were found during the eighteenth century not by the promotion of Regimental Surgeons who might possess the necessary qualifications, but by granting direct commissions to civilians. During the War of the French Revolution the newly-appointed Medical Board, having developed the General Hospitals to such an extent as to remove all their cases from the care of the Regimental Surgeons, proceeded to appoint to their charge a number of young Oxford and Cambridge physicians whose professional knowledge, though possibly profound, was mainly theoretical, and whose military experience was nil. The result

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in many cases was deplorable. The hospitals became the refuge of malingerers, the mortality was high, and the most scandalous abuses prevailed.

Since that time a certain amount of progress had been made towards reform. The Duke of York, who became Commander-in-Chief in 1796, appreciated the principle, afterwards expressed by Napier, that "superior professional skill is of little value in comparison of experience in military arrangement," and from this time onward the promotion of properly qualified serving officers to the rank of Staff Surgeon, and later to that of Physician, became the rule. At the same time, Mates newly entering the Service were made to pass an examination at Surgeons Hall, and subsequently walk the London hospitals under supervision. Both Regimental and Hospital Mates became commissioned officers, the former receiving the title of Assistant Surgeon.

The administration of the Department remained unsatisfactory owing to the manner in which its control was exercised. Of the three members who constituted the Medical Board, two, the Physician-General and the Surgeon-General, were civilians, who gave such time to their duties as they could spare from their private practice and other activities. The third, the Inspector of Regimental Hospitals, who had indeed seen some service in the Guards, was mainly concerned with checking hospital accounts. Each exercised the patronage of his own department, and they never met except on formal occasions, when they frequently quarrelled. Such a Board was not unnaturally out of touch with their own officers, and the value of their technical advice had to be much discounted owing to their want of acquaintance with military matters.

During the first years of the century a bitter and personal controversy raged as to the respective merits of General Hospitals administered by nominees of the Medical Board, and a purely Regimental System in which the practical needs of an expeditionary force in the field seem to have been lost sight of. Whether owing to this difference of opinion, or because of the demands of the great armament preparing for the invasion of Holland, or from simple parsimony and neglect on the part of the Government, the General Medical Staff in Portugal during the first two years of the war was most inadequate. Sir Arthur Wellesley, who had to organize all his administrative services himself, complained with considerable justice that Medical Officers of his force who had proved their zeal and ability in acting staff appointments, and had been recommended by himself for substantive promotion, were passed over in favour of others who had secured the patronage of the Board. That the staff was eventually made up by the despatch from England "not of gentlemen of rank, but of Hospital Mates" was in accordance with his own expressed wish at the conclusion of the Talavera campaign. Napier, Colonel Hall, and other contemporary historians severely criticize the employment of these young men in positions for which their experience rendered them unfitted.

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Sergeant Donaldson of the 94th, who could appreciate a good officer, even though he possessed only what he called "a fair knowledge of his profession," described them as "apothecaries' boys, who, having studied a session or two, were thrust into the Army as a huge dissecting-room, where they might mangle with impunity."[1] They were unquestionably badly treated. They held the King's commission, but without the social position usually attached to it. Landing in a country the language of which they could not speak, they were thrown into billets where they had to look after themselves. They were not allowed a soldier servant, and their Portuguese batmen usually swindled them. They had neither seniority in the Army nor among themselves. Their pay was miserably small, and some seem even to have been tempted to appropriate medical comforts from the hospitals for their subsistence. Most, after a year's service, passed on to regiments as Assistant Surgeons, where they first obtained some knowledge of the soldier's life, and a chance, if they were worth their salt, to win the respect to which their rank and uniform entitled them.

The Staff Surgeons in the Peninsular war were many of them men appointed by the Commander of the Forces to acting rank from that of regimental surgeon. The greatest surgeon the war produced was undoubtedly George James Guthrie, who went out as surgeon of the 29th Foot, and retired afterwards as Deputy Inspector. John Hunter once remarked that practice, not precept, seemed to be the guide of all students of the military branch of surgery, and from Guthrie's writings the remark was apparently still not inapplicable. Amputations were, in his opinion, far too numerous, and he made himself unpopular with higher authority by urging the general adoption of more conservative methods. Among his innovations were joint excisions, ligature of both ends of wounded arteries, free incisions for erysipelas, and the use of mineral acids in hospital gangrene. The method of leaving a fractured thigh in the bent position lying on its side, which was customary, produced a deformity like a ram's horns. He introduced the long splint in military practice. His reputation in the Expeditionary Force was a very high one. He endeavoured to lay down certain principles, and he succeeded to a certain degree in getting them established. At the latter end of the war McGrigor spoke highly of the skill of his surgeons.

Others whose names are honourably connected with the surgery of the Peninsular war are John Hennen, Charles Boutflower, W. R. Morel, Samuel Woolriche, Edward Tegart, John Gunning, and Somers Higgins. Some of these worked in the General Hospitals, others were the P.M.O.'s of Divisions, where they were consulting and operating surgeons as well as administrators.

The number of physicians on the active list of the Army was never

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[1] "Recollections of the Adventurous Life of a Soldier." The author in later life became a surgeon, but not, apparently, a very successful one.

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great. Their salary at the rate of a pound a day was still a handsome one,[1] but as a class they had somewhat fallen from the position they had claimed in the previous war in virtue of their superior medical qualifications. The introduction of the grade of Deputy Inspector, for which surgeons were equally eligible, had also put them in the shade. The Peninsular physicians seem most of them to have been through the mill as regimental Assistant Surgeons. James Franck, the Inspector of Hospitals, had been a physician. The officer employed at General Headquarters was J. R. Hume, late of the 79th, who continued to attend Wellington to the end of his days, and died a Commissioner in Lunacy. Sir James Fellows, another physician, and of some note as a writer on pestilential fevers, did well as P.M.O. to Graham's army in Cadiz. Charles Tyce won Wellington's special approbation. Adam Neale, who went through the Vimeiro campaign and was with Sir John Moore's army, is one of the historians of the Corunna campaign; George Denecke and Theodore Gordon, the last a divisional P.M.O., also rose to distinction in the Service.

Of the Deputy Inspectors, William Fergusson, the medical chief of Beresford's army, alone calls for special mention. Apart from his administrative abilities, his contributions to medical literature, especially his original observations on malaria, are of permanent value. The remaining medical gentlemen include the apothecaries and the purveyors. The former were commissioned as medical officers. Their designation sufficiently indicates their duties. The latter were the keepers of all medical stores other than drugs. The deputy purveyors of the General Hospitals were responsible for the rations, the accounts, and for the care of the pack store and all hospital equipment. Formerly appointments were made to this branch from the surgeons and assistant surgeons, but they were now made from the purveyor's clerks. These officers were posted and transferred by the Inspector of Hospitals, but were financially responsible through the Purveyor General direct to the Treasury. The job appears to have been a thankless one, and they were constantly in hot water. Their temptations were considerable, and it seems only too true that some of them yielded to them and feathered their own nests. Writing to Sir James McGrigor on February 9, 1814, the Adjutant-General said: "The Field Martial has further directed me to take this occasion to explain to you the scandalous waste of the public money by the Purveyor's Department, the immense expense of the General Hospitals, and the general inattention to duty of that Department have long been subjects of serious uneasiness to his Lordship, insomuch as to determine His Excellency to draw the attention of His Majesty's Government to that branch of the Service with a view to alteration of the whole system." After the war the purveyors,

[1] The rates of pay in 1807 were: Inspector of Hospitals £2, Deputy Inspector £1 5s., Physician £1, Staff Surgeon 15s., Hospital Mates and Assistant Surgeons 7s. 6d. The Regimental Surgeon got 11s., rising to 18s. after twenty years' service.

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being no longer needed, mostly went on half-pay, but no new plan was worked out, and the Crimean War of 1854 was commenced under the same system.

Lastly, we come to the Chief of the Medical Service in the field. His duties, as understood by Dr. James Franck, Wellington's first Inspector of Hospitals, seem to have been to see that his officers carried out the medical treatment of their patients efficiently, to know something about their distribution and, so far as his resources allowed, to keep the General Hospitals supplied with medical staff officers and medical and purveyor's stores. He had to produce a morning state for the Commander of the Forces, and it was a definite part of his duties to represent any conditions which were adversely affecting the health of the troops. For the rest, he had to carry out such orders in connection with medical administration as he might receive through the Adjutant-General. These duties, we have Lord Wellington's statement to prove, he fulfilled to his Lordship's entire satisfaction. It remained for his successor to show that, given a share of the confidence of the Commander-in-Chief, and allowed a reasonable latitude in making arrangements on his own responsibility, he could not only relieve the latter of a vast amount of work in connection with casualties which he had previously personally attended to, but that the work was more efficiently performed. The status of the Chief of the Medical Department as won by McGrigor was lost before the next great war, and it was seventy years before it was regained.

The Hospitals.

Under peace conditions the sick soldier received medical attention from his own regimental medical officers, of which there were two to a battalion, and in his own hospital. The arrangement was popular with all immediately concerned, and, despite orders to the contrary, the natural tendency was to revert to the same system in war whenever opportunity offered. But there was no transport to render the Regimental Hospital mobile, and, when the Army was on the march, the sick had to be left in depots formed at intervals of thirty to forty miles. These usually became General Hospitals. During an engagement a large proportion of the necessary operations were performed in the brigade dressing stations by the regimental surgeons, and at the same time a General Hospital would probably be opened in the immediate vicinity. But General Hospitals were in no sense considered as special centres where facilities for treatment not otherwise available could be found. They were rather dumps where sick and wounded unable to march could be deposited.

When a General Hospital was ordered, the equipment, consisting of trestle beds, bedding, and hospital clothing, was supplied from the purveyors' stores if available, otherwise by requisition from the inhabitants. The Inspector of Hospitals supplied the medical stores, and the medical staff, if he had it, a staff surgeon, a physician, an apothecary, deputy

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purveyor, and a number of hospital mates. In the early days of the war the Surgeons usually had to come from the regiments. The number of patients arranged for was, as a rule, 300.

Failing the formation of a General Hospital, a Brigade or Divisional Hospital might be ordered. This was a unit improvised from local resources and staffed by the Brigades. The Senior Medical Officer, as in the case of Regimental Hospitals, had to victual his patients, and to enable him to do so, the Regimental Paymasters left with him subsistence money at the rate of 9d. a head per day. This was stopped from the soldier's pay.

The subordinate staff and sick attendants had in all hospitals to be found from the combatant ranks, and a regimental officer had to be appointed as Commandant. Owing to the course the war took, several of the General Hospitals acquired a permanent character, and large hospital centres grew up, notably at Lisbon, Abrantes, Coimbra, Elvas and Oporto. To these Deputy Inspectors of Hospitals were appointed.

There was a large Convalescent Depot at Belem, a suburb of Lisbon, and others in connection with the remaining hospital centres. They were a constant source of trouble owing to the indiscipline of the inmates and the accumulation of malingerers. Unlike those in our last war, which did so much to prevent sick wastage, they did much to increase it. The men were confined to barracks, their only recreation being to break out and get drunk in the town, which they constantly did. The officers appointed to command these depots were usually invalids or men otherwise unfit for regimental duty, and, judging from the General Orders, the depots were more than they could cope with. The Medical Officers, having no disciplinary powers, could not be expected to lend much assistance in keeping order, nor was it expected of them.

During the Flanders campaign a number of General Hospitals were formed in England and Scotland for the reception of sick from the front, but, except for the Depot Hospital in the Isle of Wight and the York Hospital at Chelsea, these had all been broken up by the year 1806. There is no evidence in Wellington's orders and despatches that there was any regular system of evacuation of sick to England from Portugal, other than the embarkation of men permanently crippled on returning transports.

The Sick Officer.

No hospital accommodation was provided for the sick or wounded officer. He was put into a billet which might be comfortable, or very much the reverse, with his soldier servant to look after him. Sir Harry Smith, then a subaltern in the Light Division, was wounded in the ankle at the engagement on the Coa. He travelled to Pinhel on a sick convoy, was sent down the Mondego in a boat, and transhipped to Lisbon. Here he was put with another officer into an empty house. He was later

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removed to the Convalescent Depot at Belem, but, being anxious to get back, he got put in charge of a convoy of convalescents and rejoined with a stiff ankle. After the siege of Ciudad Rodrigo he returned to Lisbon. "I was ordered to Buenos Ayres to be near the surgeons. A board was held consisting of the celebrated Staff Surgeon Morell[1] who had attended me before, Higgins and Brownrigg. They examined my leg. I was all for operation. Morell and Higgins recommended me to remain with a stiff leg of my own as better than a wooden one, for the wounds at Lisbon of late had sloughed so they were dubious of the result. Brownrigg said, 'If it were my leg, out should come the ball.' On which I roared out, 'Hurrah Brownrigg, you are the doctor for me!' So Morell says, 'Very well, if you are desirous we will do it *directly*.' My pluck was somewhat cooled, but I cocked up my leg and said, 'There it is, slash away.' It was five minutes, most painful indeed, before it was extracted. The ball was jagged, and the tendinous fibres had been so grown into it, it was half dissected and half torn out with most excruciating torture for a moment, the forceps breaking which had hold of the ball. George Simmons was present, whose wound had broken out and obliged him to go to Lisbon. The surgeon wanted some linen during the operation so I said, 'George, tear a shirt,' which my servant handed to him. He turned it about, and said, 'No, it is a pity, it is a good shirt.' At which I did not,—— him a few, for my leg was aching and smoking from a wound four or five inches long."

Sick Transport and Convoys.

Supplies in Wellington's army were mainly carried on mules or donkeys, and this was frequently the only mode of moving the sick available. The Portuguese ox wagons were also largely used, and their movements on the rocky roads caused the wounded the utmost agony. The wheels, which were octagonal rather than round, were fixed in the axle, and, having no tyres, pieces were liable to break off at the circumference. The oxen were driven by poking them with a long stick with a nail at the end. When so urged, they broke into a zig-zag trot. The rate of travel was about two miles an hour. A small wagon train had been brought from England including some spring carts. In the latter half of the war three of these were attached to each division and used exclusively for ambulances. The Douro, the Tagus and the Mondego rivers were navigable, and from Figueras, at the mouth of the latter, transport to Lisbon by sea could be arranged. The French had an organized ambulance corps with wagons. In every respect except this their medical arrangements were inferior to ours.

Transfer of patients to and from general Hospital caused endless trouble, kit was lost and desertion a frequent offence. Men broke away from the returning convoys in search of loot, and the command of these detachments

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[1] Staff Surgeon R. Morel.

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was dreaded by the subalterns. The anonymous writer of the Introduction to "Wellington's General Orders" says: "There is no duty so vexatious as the detachment of wounded to the rear. The eternal schreeching of the ungreased wheels of the Portugese bullock carts which too often irritate the sick man into a fever, if he has not one already, the breaking down of the cars or the escape of the drivers with the bullocks belonging to others, the upsetting of the wagon train wagons from the badness of the rocky roads, the assembly of the sick in the morning, the only novelty being some new misery, such as to become sexton and bury a man who died during the night or on the road, are daily occurrences, And if by chance he (the subaltern) has conducted the whole to the General Hospital without having forfeited his commission, the only prospect before him is that he will be ordered to conduct back from the hospital the recovered men of twenty different battalions, who, having been free for some time from regimental military constraint, give trouble that no one can describe."

(To be continued.)

Current Literature.

VERNON, H. M. **Methods of Heating and Ventilating Schools and their Influence on Health.** *Domestic Engineering.* 1928, v. 48, 201-6; 231-2, 8 figs. [3 refs.]

Of this paper a leading article says: "Those favouring mechanical ventilation will obtain little support, for he agrees with established custom that the natural system is preferable if worked properly. . . . He believes in a good system of cross window ventilation, and not the old method of ceiling extracts exhausting into ducts connected to ventilating turrets on the roof."

The chief desiderata are given as: (*a*) A temperature giving comfort without lethargy; (*b*) transposable inlet and outlet areas of 30 sq. inches per pupil so that nearly all room-air is scavenged well without draught; and (*c*) easily-controlled, economical working.

Mr. WIDDOWS' Derbyshire type of school is well figured, with its glazed wall panels capable of being used with the upper part serving as hoppered or wide-open window, while the whole of the panels may be swung wide open so that the room is without a wall on that side. With similar windows in fixed walls upon the opposite side of the room, and heating by two 3½ inch low-pressure hot-water pipes (at 7 inches from floor) connecting hot-water radiators beneath the open hopper-windows, excellent ventilation can be secured with an almost uniform "temperature gradient" showing only 1° F. difference between the temperatures at floor and head levels.

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Good heating is also obtainable by hypocaust (under-floor) and ceiling-panel methods, in contrast with plenum air-heated factories and overhead-steam-pipe-heated workrooms in which the temperatures at 10 ft. high have been found 23° and 11° F. respectively above floor-level temperatures.

Some interesting new work on the results of various temperatures upon manual dexterity is referred to in a way which suggests an interim finding, to be amplified later. [In view of the importance of this matter it is to be hoped that this is so, as the results challenge some modern ideas and one would like data *re* efficiency other than those dealing with manual dexterity and palm temperatures. Moreover, one would wish for observations at room temperature of 57° F. under a cooling-power of less than 8·3 before forming the conclusion that such a temperature is too low.]

Valuable information *re* the influence of floor-space and ventilation upon the school attendances of 5,000 children for a year may be conveniently tabulated thus, for reference and citation :—

Floor-space.

Sq. feet per child.	*Per cent. absences for a year.*
Under 14′ (mean 12½)	10·1 per cent.
Over 14′ (mean 16½)	7·5 per cent.

Ventilation.

Type of School.	*Ventilation.*	*Floor space per child.* sq. ft.	*Absences.* Per cent.
Semi-open-air	Full, cross	14·4	7·9
Ordinary English	Very good	13·2	6·1
,,	Moderate	14·0	9·3
,,	Poor	14·7	10·4

From which it will be evident that, although floor-space is important, the schools with the lowest floor-space were enabled by excellent ventilation to secure the lowest percentage of absences.

With regard to the final table correlating school temperatures with absenteeism, it is necessary again to ask for the further details which Dr. Vernon's remarkable thoroughness ensures before drawing rigid conclusions. It would, e.g., be an unacceptable conclusion that children in a stagnant atmosphere at 60° F. would give less absenteeism than children in a similar room in which the temperature had been reduced to 55° F. by free currents of fresh air. There is also the consideration that schools designed so well as to give a temperature of 60° F., may fairly safely be presumed to give also better circulation of air than schools so poorly warmed as to give temperatures of only 50° F. It is thus obvious that average speeds of air-current must be correlated with temperatures before legitimate conclusions can be drawn.

[Dr. Vernon provides a very valuable summary of recent work and views on this important subject, on which his own researches render him particularly competent to speak authoritatively.]

P. S. Lelean.

Reprinted from "Bulletin of Hygiene," Vol. 4, No. 9.

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TOOMEY, J. A. **Treatment and Prevention of Scarlet Fever by Specific Antitoxins and Serums. Review of the Literature.** *J. Amer. M. Ass.* 1928, v. 91, 1599-602. [30 refs.] [Cleveland City Hosp. & School of Med., Western Reserve Univ., Cleveland.]

A low death rate from scarlet fever is the rule at present throughout the United States and has been for some years, whilst according to CHAPIN'S records for Providence the prevalence remains about the same. No evidence as to the efficacy of scarlet fever antitoxin can be obtained from the mortality figures, and though such claims have been made as a result of the study of hospital statistics they are not valid unless account is taken of the general scarlet fever fatality rates in the district which the hospital serves, as the most serious cases are likely to be found in hospital. Furthermore the actual deaths themselves must be carefully scrutinized since hospital cases often have " admission handicaps" from which nothing can save them ; e.g., the puerperal type of septic scarlet fever, scarlet fever with peritonitis, scarlet fever with burns, and concurrent scarlet fever and diphtheria. Statistics are given from Cleveland City Hospital in support of this argument. Other sources of fallacy in reports are that the day on which the serum was given was not taken into consideration nor the prevailing type of the disease at the moment. The severity of scarlet fever exhibits great fluctuations in different epidemics, and even from month to month and it is unwise to compare results of serum-treated cases with untreated cases which leave these factors out of account. The author states that in the literature available to him he has found records of 4,611 serum-treated patients. Of these 26 per cent. only had controls from the same epidemic. For the remainder controls were chosen from other epidemics or there were no controls. He then proceeds to analyse the more critical efforts. The disappearance of the rash following antitoxin is usually stated to be the effect of the antitoxin but it is noted that many fail to give data in support of this or fail to mention the day of disease when treatment was begun. In his own serum-treated cases there were more patients losing their rash in the first 48 hours than in the untreated but this was more than counterbalanced by the fact that in the next four days more of the untreated lost the rash than the treated. With regard to the effect on pyrexia, he finds the literature confusing and whilst most workers have found a rapid return to normal after antitoxin, as a result of his own work he finds there is not much lessening in duration of fever after intramuscular injection, although after intravenous injection there is a sharp fall. With reference to duration of the toxicity, although most report a rapid diminution in symptoms, and in his own cases there was a slight reduction in the toxic period, he thinks the difference was anything but conclusive. On the vexed question of complications he again finds no uniformity as many claim a definite reduction, and some a slight reduction, while in his own cases there were 39·2 per cent. among the treated compared with 36·6 in the untreated. Summing up in the most favourable way it may be granted that the rash fades, fever

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is reduced and toxicity disappears a day or two earlier in the treated, compared with the untreated patient. The percentage of cases of serum sickness is high, generally between 20 and 30 or over. In his own experience the author found 38·5 per cent. of cases of serum sickness and 3 deaths due to or hastened by antitoxin and he doubts if it is worth while to give antitoxin just to see the patient better a day or two sooner and have serum sickness, which in his own cases gave rise to more illness than the disease itself. He states, "I myself have yet to see the data of a series treated with intramuscular injections of scarlet fever antitoxin which I could not, without much discredit, match with a series of my own untreated cases." In discussing the prophylactic value of the antitoxin he is also pessimistic about some of the work reported. Little of it has been properly controlled and considering that 24,865 cases in Providence gave rise to 2,138 or 8·6 per cent. of secondary cases he is in doubt about the advisability of using the antitoxin for passive immunization. He is enthusiastic, however, about the results of active immunization which "has practically eradicated scarlet fever from the resident population of our hospitals."

[This is a very valuable paper which should be read in conjunction with that of BANKS and MACKENZIE, *infra*. In spite of these informed criticisms, clinical observation does not count for nothing, and moreover it will be observed that the results of the treatment of the toxic type of the disease by scarlet fever antitoxin is not dealt with, although a fair number of these have now been described in the literature.] A. JOE.

Reprinted from "Bulletin of Hygiene," Vol. 4, No. 9.

Reviews.

LA SIGNORA DALLA LAMPADA (FIORENZA NIGHTINGALE). By Tenente Colonnello Medico Arturo Casarini, Italy. Rome: Stabilimento Poligrafico dello Stato. 1929.

The fact that Florence Nightingale was born in Florence is perhaps forgotten in this country; but the Italians know it and honour the British by their recognition of her as a daughter of the Arno. To her beautiful birthplace she may have owed that *flair* for originality which led her towards unexplored regions of scope and utility. The Briton who realizes that she was one of the pioneers of the world will take a pride in the readiness of Italy, so imaginative and patriotic, to see in the Lady of the Lamp a heroine whom the Italian Nation cherishes as one of its own. She rests as a link of remembrance between the two countries. And the tribute that is paid to her glorious memory shows us that the friendship and helpfulness that united Great Britain to Italy during the trials of the Risorgimento are still alive. We may not always understand, though we admire, the super-efficiency of the Italian *régime*, and perhaps chafe under

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the disciplinary legislation; but we know, from signs such as Colonel Casarini's book, that the old comradeship between Italy and this country remains firm.

It is a charming compliment that Colonel Casarini, whom many of us had the pleasure of meeting at the recent International Congress, has paid to the Royal Army Medical Corps. His interesting and well-written book is dedicated to the "Corpo Sanitario Militare Inglese," which is Us; and we must thank Colonel Casarini and the *Giornale di Medicina Militare* for a very friendly and graceful gesture. He has much to say about the influence of Rome on Great Britain, when the Legions of the Eternal City did garrison duty in many of the stations in which we now serve. And he refers to the unselfish followers of the Lady of the Lamp, who emulated her noble deeds on the Italian front during the Great War. Wonderful reading it is, in a language that is gifted with a charm of expression which is denied to ours; but it is not the language, perfect though it be, so much as the spirit of genuine admiration for our heroine, and the obvious sincerity of the writer in his kindly outlook towards us, which is the essential feature of a delightful work.

I feel that the medical services of the world are slowly coming together, weaving themselves into an international body for the advancement of medical science; we are laying the foundation of a novel and practical Health League of Nations that becomes a factor in World Peace and World Progress. And it is by the expression of sentiments like those of Colonel Casarini in his "Fiorenza Nightingale" that we can gauge the strength of this new trend towards international co-operation, and efficiency, among our sister medical services. M. B. H. R.

DISEASES OF THE THYROID GLAND. By Arthur E. Hertzler, M.D., Surgeon to the Halstead Hospital, Kansas. Second Edition. London: Henry Kimpton. 1929. Pp. 286, figs. 159. 32s. net.

Dr. Hertzler believes that whatever merit this volume may have lies in the fact that it is the result of his experience and research in a small isolated country hospital, where he has been able to work untrammelled by the opinion of others. The reader will be likely to form the opinion that its chief merit lies in the breezy freshness of its style.

The subject is discussed under the headings of pathological anatomy, symptomatology, and diagnosis and treatment.

Although there is nothing much that is new in the views expressed, it is a volume that is worth reading, especially for its pathological descriptions and illustrations, and for the details of surgical procedure. The author considers that the various varieties of goitre are merely stages of one disorder and finds no good from treatment of exophthalmic goitre by X-rays.

The get-up of the book and reproduction of photographs and photomicrographs are excellent.

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THE HYGIENE OF MARRIAGE. By Isabel Emslie Hutton, M.D. Second Edition. London: William Heinemann (Medical Books) Ltd. 1929. Pp. x + 125. Price 5s. net.

We are glad to see that a second edition of this useful book has been published.

New chapters have been added so now the book covers the whole period of reproductive life. Those about to marry and those who are married will gain much useful knowledge and save themselves much worry and anxiety if they read carefully the clearly expressed facts contained in this little volume.

In no other work have we found the hygiene of sex so well explained and in such good taste, and in accordance with modern scientific knowledge. Medical practitioners can save themselves having to answer many awkward questions if they recommend their patients to buy and read this book. F. C. D.

THE DIAGNOSTICS AND TREATMENT OF TROPICAL DISEASES. By E. R. Stitt, M.D., Sc.D., LL.D. Fifth Edition. London: Lewis and Co. Pp. xix + 918. Price 31s. 6d.

Stitt's "Tropical Diseases" has taken thought and added several cubits to its stature so that the new edition is about three times the actual weight of the old. No doubt this increase adds to the intrinsic value of the work as a unit, but thereby the student of tropical medicine is deprived of a unique compendium which he could carry in the pocket of a greatcoat, and use to revise his reading of more ponderous tomes.

The new material appearing in this edition includes six chapters—of which one on vitamins calls for special mention by reason of its outstanding excellence—as well as an extensive appendix in four sections, two of them dealing with laboratory procedures, a most valuable addition, clear and practical, and likely to encourage co-operation between the clinician and the pathologist, a partnership so essential in tropical medicine. The original subject matter has been revised and in part rewritten and rearranged, and the employment of small type for the discussion of points considered less important—so prominent a feature of previous editions—has been discarded.

In its new class Stitt's "Tropical Diseases" will undoubtedly maintain the high reputation won so deservedly in its previous humbler guise.

AN INTRODUCTION TO THE STUDY OF THE NERVOUS SYSTEM. By E. E. Hewer, D.Sc.Lond., and G. W. Sandes, M.B., B.S.Lond. London: Wm. Heinemann (Medical Books) Ltd. 1929. Crown quarto. Pp. xii + 104. 55 diagrams. 21s. net.

Students, especially those working for the higher examinations in medicine, will find this volume of the utmost value. There is no subject so complex and difficult to the average man as the study of the nervous system from both the anatomical and the physiological aspects. The

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authors have succeeded in rendering it as simple as it can be made; they have obviously a great experience of teaching and have chosen to describe only such facts connected with the minute structure and function of the nervous system as are absolutely necessary for the student to know; brevity and clearness have been aimed at and attained.

The many coloured diagrams showing the various nerve connexions and paths are beautifully clear. References are comparatively few, but ample.

BAILLIÈRE'S SYNTHETIC ANATOMY. By J. E. Cheesman. London: Baillière, Tindall and Cox. 1929. In thirteen parts, 9 × 7½ in. Price 3s. each.

This publication is a most ingenious aid to the study of anatomy for those who have not the opportunity of referring to actual dissections. Each part contains twelve drawings on transparent paper showing the positions of the various structures in each of twelve sections comprising the whole thickness of the part of the body concerned. It is thus possible to study the relations of any structure by examining one transparent sheet over a white background or several sheets together. The drawings are prepared on scales proportionate to the complexity of the region represented. For example, one set shows the leg and foot on a small scale, and and in another the detail of the foot is given in something approaching life size.

The plates are printed in six conventional colours and are accompanied by index sheets enabling the student to identify the various structures by means of numbers and references analogous to those used in map reading. Each part is in a stiff paper cover perforated for binding in a loose-leaf binder supplied by the publishers. Parts dealing with the upper arm and shoulder, the forearm, the hand, the head and neck, the pterygo-maxillary region, the foot, and the leg have already been issued; the remainder are in course of preparation.

BACTERIOLOGY AND SANITARY SCIENCE. By Louis Gershenfeld, Ph.M., B.Sc., P.D., Professor of Bacteriology and Hygiene in the Philadelphia College of Pharmacy and Science, Philadelphia. Pp. xv + 432. 30 engravings and 2 plates. Philadelphia: Lea and Fibiger. 1929.

The author states in the preface that this book is intended for the use of students of pharmacy, chemistry and allied sciences, and in it he deals with bacteriology, animal parasitology, infection, immunity and sanitary science.

This is a very extensive range of subjects with which to cope in one book and the greater part of the information given is of a superficial nature; this is well seen in the subject of helminthology which is covered in seven pages.

"Sanitary Science" which includes ventilation, disposal of waste, water supplies and milk and other foods, is allotted only forty pages, so one cannot expect much detail.

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Part III, in which are treated infection, immunity, allergy and biological products, is perhaps the best part of the book and gives a good résumé of these subjects.

The book is founded on courses of lectures delivered by the author and although the information it contains may be sufficient for science students, the outlines of most of the subjects dealt with are so curtailed as to be of slight value to medical readers.

Notice.

"THE JOURNAL OF THE ROYAL ARMY VETERINARY CORPS."

We have much pleasure in welcoming a new regimental journal. The first issue of the *Journal of the Royal Army Veterinary Corps* appeared in November, 1929, and it promises to be a most useful and interesting publication, not only to the members of the R.A.V.C., for whom it is primarily intended, but also to all those who are interested in horses and other animals employed for transport purposes in the Army. Nowadays, if we wish to appear up-to-date, we discuss eagerly the problems of mechanization, but the fact remains that for many years to come we shall have to rely on horses, mules, camels, bullocks, and even donkeys, for the transport of part at least of our personnel, munitions and stores, and problems of the supply and maintenance of these animals on active service will be of great importance.

Between the R.A.M.C. and the R.A.V.C. there is an additional bond of interest. With the steadily broadening outlook of medical science we are more and more able to appreciate the help we may get in the elucidation and control of human disease by the study of disease in animals, and those directly concerned with the care of animals are not slow to profit by advances in human medicine, surgery and pathology.

The first article in this new Journal is an account of the operation of veterinary units at the beginning of the Great War, and it is at once obvious that the situations they had to deal with had many analogies with those of the Medical Services. This is followed by a memoir to Major-General Sir Frederick Smith, papers on "dislocation of the patella," surra, trypanosomiasis of camels, phosphorus poisoning of sheep after contamination of ground with smoke shell; a group of clinical notes; a paper on the supply of horses to Territorial Camps, and an account of "My Best Horse." The issue concludes with notes on sport and Corps news.

The Journal is bound in maroon paper with the Corps crest in gold. The printing, paper and illustrations are excellent, and are a credit to Messrs. Gale and Polden. It is to appear quarterly, and the price is 3s. per copy, or 10s. 6d. per annum, post free to any part of the world.

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VOL. LIV. FEBRUARY, 1930. No. 2.

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Journal
of the
Royal Army Medical Corps.

Original Communications.

THE GENEVA CONVENTIONS OF 1929.

BY MAJOR-GENERAL D. J. COLLINS, C.B., C.M.G.

THE Diplomatic Conference which assembled at Geneva on July 1, 1929, at the invitation of the Swiss Federal Council was concluded on July 27 with the signing by the parties concerned of two conventions, the first revising the Geneva Convention of 1906 for the amelioration of the condition of sick and wounded in war, the second dealing with the treatment of prisoners of war. The International Red Cross Committee deserves credit for taking the initiative in both these problems, for it was the draft conventions prepared and approved at the International Red Cross Conferences of 1921 and 1923, that led to a proposal in this connection being addressed to Governments in 1925, and finally to the Diplomatic Conference which has just concluded.

It may be of interest to recall that the foundation of the International Red Cross organization, and indirectly the first Geneva Convention of 1864, owe their inception to a Swiss gentleman, Henri Dunant, who was present at the Battle of Solferino in June, 1859, when French and Italian armies attacked a position strongly defended by Austrians. More than 300,000 troops were engaged, the battle raged at close quarters for fifteen hours, the casualties were enormous, and it was stated that "the plains of Lombardy were reddened with the blood of myriads of wounded," to deal with whom the medical services were totally inadequate.

A little book entitled "A Souvenir of Solferino," published by Dunant in 1862, descriptive of the sufferings of the wounded and the horrors of the day, attracted European attention. He urged the formation in all countries of Voluntary Aid Societies to succour the wounded in war time,

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and to assist the army medical services both in the hospitals and in the field. During peace, the societies were to be more or less inactive, but would be made use of in severe epidemics, or in time of national disasters, such as earthquakes, flood, volcanic eruptions, etc. Dunant's efforts to interest European Governments in his scheme for rendering first aid to the wounded met with marked success, for in October, 1863, an International Conference, representative of fourteen Governments (including Great Britain) met at Geneva and laid the foundation of the International Red Cross Committee of the present day. It recommended the establishment in each country of a Red Cross Committee, whose duties would be in time of peace to train nurses for service in war and in time of war to co-operate with, and to supplement, the army medical services.

In the following year, sixteen nations were represented diplomatically at Geneva, and the first Geneva Convention (1864) was formulated, which provided for the neutrality of: (*a*) field ambulances and hospitals, as long as they contained sick or wounded, and (*b*) of the personnel employed with these units; sick and wounded to be taken care of irrespective of nationality; protection to be afforded to persons or buildings sheltering sick or wounded; a distinctive armlet to be worn by all persons protected by the Convention; a distinctive flag for medical units, to be flown along with the national flag; the emblem of the medical services to be a red cross on a white ground, formed (as a compliment to Switzerland) by reversing the arms of the Swiss Federal Government, which include a white cross on a red ground.

It is worth recording, perhaps, that Dunant himself attributed his inspiration to Florence Nightingale, "the lady with a lamp," whose services, during the Crimean War and after, are historical, for in a lecture delivered in London in 1872 Dunant said, "Though I am known as the founder of the Red Cross and the originator of the Geneva Convention, it was an Englishwoman to whom all the honour of that Convention is due. What inspired me to go to Italy during the war of 1859 was the work of Miss Florence Nightingale in the Crimea."

At the Conference that opened at Geneva on July 1, 1929, forty-seven Governments were represented by delegations, and there were in addition delegates from the International Red Cross Committee, the Sovereign and Military Order of Malta and the League of Nations.

The Conference, on the first day, decided to divide into two general committees, one to deal with the revision of the second Geneva Convention (1906), and the other to draft a code for prisoners of war. The real work of the Conference was done by these committees and their sub-committees, and no general meeting of the whole Conference was again summoned until July 26, when two reports setting forth the work of the respective committees and two draft Conventions were submitted for the general approval of the delegates, and on the following day the Conventions were signed by the plenipotentiaries of thirty-two Governments.

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The first Geneva Convention was revised in 1906, and introduced some new material; for example, reference was made to the Voluntary Aid Societies of belligerents, which were not referred to in the Convention of 1864, and had therefore no rights under it. The Voluntary Aid Societies had steadily developed since 1863, and had enabled the Red Cross Society to extend its sphere of activity to a maximum, and these organizations were accordingly in 1906 granted "respect and protection."

The recent Conference submitted the Convention of 1906 to a thorough and critical examination, although it was admitted that its provisions had successfully stood the test of the Great War. It was, however, felt that certain defects had been discovered in the fabric, that certain articles might be made more definite, and that several passages liable to misinterpretation might be clarified.

To get a comprehensive view of the work accomplished in July and the progress made, a comparative study of the two Geneva Conventions—that of 1906 and the recent one—is necessary, and anyone desirous of further pursuing the subject will find very interesting reports in the July and August numbers of the *Revue internationale de la Croix-Rouge*. Here it will be sufficient to comment on some of the chief points.

Articles 3 and 4 contain provisions of a more precise nature to ensure that after each battle the field is searched for wounded and dead soldiers; that before burial or cremation there is a careful examination to establish identification and to ascertain that the man is really dead; that the dead are given an honourable burial; that their graves are respected, and can always be identified. For this latter purpose, an organization similar to our War Graves Commission must be set up by belligerents on the outbreak of hostilities. These organizations are, on the termination of hostilities, to exchange the lists of graves and the names of persons buried in their respective cemeteries.

Article 18, concerning the protection of air ambulances, is a new feature, in so far as the Geneva Convention is concerned, although this subject was discussed at the International Red Cross Conferences held in Geneva in 1923 and 1925, and very fully at The Hague in October 1928, where it was finally decided that this was a matter outside the scope of that Conference of Red Cross delegates and Government representatives, but within the competence of the Diplomatic Conference of 1929. This article extends the protection of the Geneva Convention to air ambulances engaged exclusively in the evacuation of sick and wounded, or in the transport either of medical personnel, or urgently needed medical equipment. Air ambulances should be painted white, and should have the Red Cross emblem, along with the national colours, on their upper and lower aspects. Without special and express permission, they are forbidden to fly over the line of fire, or over the zone in front of the casualty clearing units, or over enemy territory. They must obey every summons to land. In the case of forced or other landing in enemy territory, the personnel and the equipment, as well as

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the machine itself, come under the protection of the Geneva Convention. The pilots, wireless operators and mechanics are to be repatriated, on condition that until the cessation of hostilities, they are not further employed in warfare, otherwise than in the medical services.

The emblem, the Red Cross on a white ground, universally respected and recognized, remains the distinctive sign of the medical services, and the use of the Red Crescent and of the Red Lion and Sun, adopted by certain Moslem countries, is now permitted by Article 19 of the new Convention.

Duly recognized Voluntary Aid Societies are authorized by Article 24 to make use of the Red Cross emblem in connection with their humanitarian activities in peace-time. Thus what was hitherto a privilege granted to them now becomes a right.

Further, subject to the laws in force in their respective countries, the emblem may also be used under the special authority of National Red Cross Societies to indicate Aid Posts exclusively devoted to the gratuitous treatment of sick or injured persons. But, as M. Paul Dinichert, the Chairman of the Diplomatic Conference, has remarked, " these Societies will be well advised to grant such permission with the greatest reserve and on the understanding that their own responsibility is thereby involved."

Abuse of the emblem and the improper use of the term Red Cross are legislated for in Article 28, in which the parties signatory to the Convention undertake to prevent not only improper use of the distinctive emblem and of the designations Red Cross or Geneva Cross, but also of any sign or designation constituting an imitation. The Conference has ordained in this article, in view of the employment by individuals and societies of the Swiss Federal emblem (the white cross on a red ground) either as trade marks or for other purposes, that the same protection as that given to the Red Cross should be accorded to the Swiss arms " in order to put an end to this reprehensible and unscrupulous practice on the part of the over-ingenious firms, who thereby speculate on the universal prestige of the Red Cross, and take advantage of the inevitable confusion arising among the public in distinguishing between the two emblems, in which the colours are identical but inverted" (M. Dinichert).

Another new article is No. 30, in which the contracting parties agree, in the event of an alleged violation of the Convention, to submit to an international court of inquiry, and if the violation is thereby confirmed, immediately to suppress it.

In drawing up the Convention dealing with the treatment of prisoners of war, the Diplomatic Conference again received great assistance from the International Red Cross Committee, who undertook the onerous task of preparing a preliminary draft of the code which formed the basis of deliberation. This draft, which originally contained 103 articles, was considered too detailed and cumbrous by some of the delegates, but no fewer than 97 of these articles were adopted or adapted by the Convention, proving that the Red Cross Committee had dealt with the problem in the right spirit.

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The guiding principles regarding the treatment of prisoners of war are laid down in Chapter II of The Hague Convention of 1907, which is concerned with the laws and customs of war on land. The experiences of the Great War proved that these principles were inadequate and incomplete. It is impossible to deal here with the ninety-seven articles of the new Convention, and I must limit myself to drawing attention to some of its provisions which are of capital importance and which are of special interest to the medical services.

Chapter II of The Hague Convention refers solely to prisoners of war on land, while Article 1 of the 1929 Convention extends its application to all categories of prisoners of war, to men taken prisoner in naval or aerial warfare, as well as on land, subject to certain exceptions resulting from the conditions of capture.

Article 2 contains another new principle: it prohibits measures of reprisal in regard to prisoners of war. M. Dinichert, President of the Convention, quoted the instructions issued to the United States armies in 1863, and they are worth repeating here: "The rules of warfare in their present form cannot prevent the adoption of measures of reprisal. Civilized nations, however, see the saddest side of war. Consequently, acts of reprisal must never be committed with the sole object of revenge; they must be adopted by way of protective punishment and, even then, with the greatest possible circumspection. Illegitimate and inconsiderate reprisals cause the belligerents to depart more and more from the regular rules of warfare and rapidly involve them in a war of extermination as practised by uncivilized races."

The conditions of prisoner-of-war camps, their food, clothing, employment, remuneration, complaints and penalties to be imposed, are dealt with in detail in the light of the experience of long years of war.

Several articles of this Convention are devoted to defining, confirming or extending the duties of the Power nominated by a belligerent to represent his interests with the adversary, on behalf of prisoners of war. The latter will in future have the right of submitting complaints and requests to the representatives of the Power whose duty it is to look after the prisoners' interests. These representatives will have the right of intervening in an active and efficient manner in the event of legal proceedings, or convictions, against prisoners. The protecting Power also will have the right to have the prisoner-of-war camps inspected by officials or by private individuals.

A chapter of the Convention is concerned with the establishment of official bureaux of information and of relief organizations, which should be set up in the different countries.

An important subject is the disposal of sick and wounded prisoners. The Geneva Convention of 1906 lays down that belligerents *may* mutually agree either to repatriate sick and wounded whom they do not wish to keep as prisoners, or to hand them over to a neutral Power with a view to internment until the cessation of hostilities. The new Convention *requires* belligerents to repatriate all prisoners of war who are seriously ill or severely

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wounded irrespective of numbers or of rank. Special agreements are to be concluded between belligerents to decide the classes of disability warranting repatriation, or admission to the hospitals of a neutral country. Another article in this connection has reference to a special agreement between belligerents regarding the repatriation, or the admission to a neutral hospital, of healthy prisoners of war who have been a certain length of time in captivity.

There are two articles (37 and 38) common to both the Conventions signed on July 27, 1929, of which mention must be made. Neither the Geneva Convention of 1906, nor The Hague Conventions dealing with the laws and customs of war on land, were binding, when one of the belligerents was not a subscriber to the Conventions. The new Conventions, on the other hand, are obligatory for the belligerents signatory thereto, even if one or more of the belligerent Powers has not signed. More than this, it is definitely enacted that a state of war will give immediate effect to the adhesion or ratification of the belligerent Powers before or after the commencement of hostilities, and that a "denunciation" of the Conventions shall remain inoperative during a war in which the denouncing Power is a belligerent.

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ANTI-MALARIA MEASURES IN MALAYA.

By Major J. H. C. WALKER,
Royal Army Medical Corps.

Part I.—Historical.

The following resolution was passed unanimously at the final session of the Malaria Section of the Congress of the Far Eastern Association of Tropical Medicine, held in Calcutta in December, 1927 :—

"As it has been represented that differences of opinion regarding the best method of controlling malaria sometimes cause doubt in the public mind and so may hamper the progress of anti-malaria work, this Congress takes this opportunity to emphasize the fact that there is no single method of malaria control applicable to all conditions and all countries. Nevertheless, they consider that for towns, mines, plantations, large public works and similar aggregations of people, *the control of the breeding places of the malaria-carrying specimens of mosquito is a method which should be employed whatever other anti-malaria measures are* put into force. Whenever possible the control should be effected by *permanent* works which eliminate entirely the source of mosquito breeding.

"For wide rural areas, especially those with scanty poverty-stricken populations, the first step in the control of malaria is adequate research so that conditions present may be ascertained as a result of such research. Methods of prevention may here be of great variety and include drainage, flooding, jungle clearing, jungle preservation, bonification, the promotion of agriculture, improvements of housing and the general economic condition, education etc., of the people. The systematic killing of infected adult mosquitoes, screening, the use of anti-malaria drugs and a host of special methods have each also to be considered in their proper application.

"The Congress desires to stress the need, not only of thoroughly trained malaria research officers, but of expert malaria engineers in whatever type of malaria prevention is at stake."

This resolution, it will be seen, insists upon the destruction of mosquito larvæ as essential for the control of malaria, and is in effect an approval of the measures of "species sanitation" already so successfully practised in Malaya. The result has been to turn attention to Malaya, and it is thought that a short account of the measures employed there might be of interest.

Malaya may be looked upon as specially favoured, as progress has been practically continuous since the work first started in 1901, twenty-eight years ago.

The control of malaria in India by means of antilarval methods was attempted in 1902 and 1903, but was unfortunately not successful, and in

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1909 at a conference held in Bombay it was said that "Mian Mir had demonstrated the futility of antilarval operations" [1].

That this should have happened was unfortunate as, no doubt, it had the effect of preventing research in India along the lines that have since proved so successful in Malaya. At the same time it has, no doubt, created a feeling of suspicion with regard to these measures which it will take time to overcome. That this is so may be judged from the recent account of "Military Hygiene and Pathology in India," in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS [2], which states that because mosquito proofing of barracks at Lahore has been successful in reducing the amount of malaria at that station, "a definite policy, suited to military needs, can now be formulated." As part of this "definite policy," "cold storage" and "mosquito proofing of barracks" are given pride of place, whilst anti-mosquito measures are placed sixth and permanent drainage is not, apparently, contemplated under any circumstances, as the only mention made of "drainage" is under the heading of "anti-malaria measures," i.e., "minor drainage schemes."

This, in spite of the resolution quoted above which was passed at Calcutta in December, 1927, and in spite of the success of anti-malaria drainage in Malaya.

"Military needs" should not be a sufficient excuse to banish completely all thought of "permanent drainage" for India, nor should the fact that drainage has failed at one station prevent its trial at other stations.

It is realized that there may be strong financial reasons for confining these anti-malaria measures to "military needs"; one and a half lakhs (£11,000) [2] for anti-malaria measures for India in 1926 does not compare very favourably with the $100,000 (about £13,000) allotted for anti-malaria work in the rural area of Singapore for the same period. It is hoped, however, to show later that permanent drainage is cheaper in the long run. In Malaya, except when opening up new areas, and drainage is in progress, mosquito proofing of houses is looked upon as an admission of failure to control the scourge at its source and it is rarely seen.

It has already been stated that progress has been continuous in Malaya. This is not strictly correct. There were numerous set-backs, but in every case the work was again continued on more or less the same lines, and some new success helped to convince people that the way to tackle malaria was by permanent antilarval measures.

The honour of being first to attempt malaria prevention by permanent drainage belongs to Sir Malcolm Watson who, in 1901, as Dr. Watson, a health officer, decided to try this method at Klang, the chief town of a district in Selangor State, one of the Federated Malay States.

Ample funds were forthcoming and success attended the first efforts at drainage. It might have been easily otherwise, and in this connection Sir Malcolm Watson says: "Although the success was due to a fortunate choice of the method adopted, as it turned out there was a real stroke of

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luck, not recognized until some years after. It was this: Had the hills of Klang been higher or had Klang been situated in the main range of hills, instead of being practically an island in the coastal plains, the clearing away of jungle from the hills and the draining of the valleys and swamps would have led to the introduction of a new malaria-carrying anopheles, certainly not less terrible than the one we got rid of by our drainage"[3].

In September, 1901, the new port for the F.M.S., Port Swettenham, was opened and the Government population and the coolies connected with shipping were transferred from Klang to Port Swettenham. Malaria immediately started, and the outbreak became so severe that within two months it was impossible to carry on the work of the port and it had to be closed, the staff and the coolies being returned to Klang. Antilarval measures were immediately commenced. "An area of about 100 acres was bunded, drained and freed from jungle (figs. 1 and 2). All possible mosquito places were oiled freely. Quinine was systematically given to all who would take it, and most did [3]. The result was that at the end of six weeks the port was again in full working order.

The work at Klang took some years to complete, but a certain measure of success was apparent soon after it was commenced and this, together with the success achieved at Port Swettenham, convinced everybody that the work had been started on the right lines. As a result the work of fighting malaria was rapidly extended by the health authorities and by private firms. Ample funds were made available by the F.M.S. Government as occasion demanded, and many further successes were reported. Large sums of money were expended in putting in permanent drainage and subsequent history shows this to have been more than justified.

As the work was extended many new problems presented themselves and were overcome. It took time to discover that a different species of mosquito with different habits carried malaria in the hills, and it took time to discover new methods of dealing with it. "In 1911 subsoil drainage, a method of putting streams underground out of the reach of anopheles, was started on Seafield Estate" [3]. Permanent anti-malaria drainage was started in Singapore and Kuala Lumpur about the same time.

The year 1911 can really be looked upon as the turning-point in anti-malaria work in Malaya; prior to that year there were at times, following failures in other countries, feelings of doubt in the minds of those responsible for these measures, but since then there has been an unbroken series of successes. At first naturally the work was crude, and many refinements and modifications have been and are still being introduced.

During this period of evolution, prior to 1911, many mistakes, some of them costly both in money and lives, were made. Some of the mistakes were due to lack of knowledge of the habits of the mosquitoes and some to lack of knowledge of the exact methods of dealing with breeding places. One of the best examples of both of these mistakes occurred at Kuala Lumpur, the capital of the Federated Malay States. The experience gained

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as a result of these mistakes has done much to influence the trend and organization of modern work, and in consequence a detailed account of the happenings at Kuala Lumpur is given. Not only have the experiences at Kuala Lumpur been directly responsible for new methods of anti-malaria

ANTI-LUDLOWI AND ANTI-UMBROSUS WORK AT PORT SWETTENHAM.

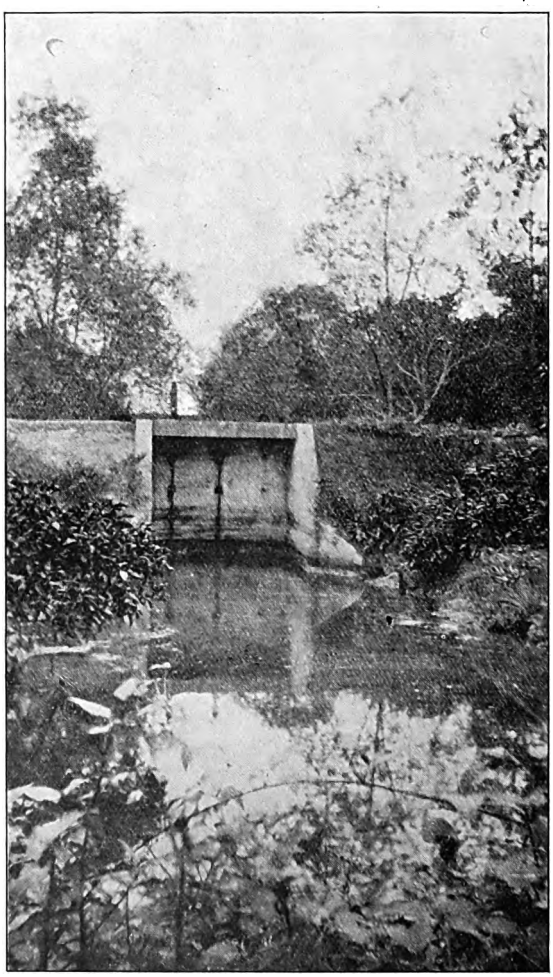


FIG. 1.—Tidal gate and part of Bund.

work, but the whole of the present organization of this work may be said to have resulted from them.

Kuala Lumpur.—The town of Kuala Lumpur at the time of these happenings covered an area of about 20 square miles, made up mostly of hills and ravines. The population in 1905 was 38,459, in 1920 it was 67,930. In 1905 most of the Europeans were housed on the hills in the European residential reserve, and prior to 1906 malaria was practically

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unknown amongst the inhabitants of this area. In 1906 a start was made, for various reasons, to clear the bush from many of the swamps and ravines, and drainage was attempted by the Public Works Department. *Malaria then appeared.* In 1907 spot maps showed that a large number of the cases of malaria came from districts in close relation to these cleared areas.



FIG. 2.—Earth drain at low tide. Quarantine Station on reclaimed ground in background.

The following abstract from a report by the Health Officer aptly describes the condition of these ravines: "The method of draining valleys below Federal Hill is far from satisfactory, if not entirely wrong, as far as the attainment of the object of preventing breeding grounds for mosquitoes is concerned. The herring-bone system adopted leaves the ground between dry, but the drains themselves are grand breeding places. The drains below the European hospital are lined with stones, and the result is the

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formation of small pools. The drains should be on the lines of Klang. Without money for upkeep it is a case of throwing money into swamps" [3].

At Klang contour hill-foot drains were used to intercept the water from the hills.

The situation became so serious that in September, 1907, the British Resident appointed a committee to examine the areas affected and advise methods for their improvement. The committee consisted of a civilian, an engineer, and two medical officers, and in addition the services of the Government entomologist were obtained.

The entomologist, Mr. C. H. Pratt, discovered larvæ of anopheles

ANTI-MACULATUS DRAINAGE.



FIG. 3.—Spun concrete invert and slab made by Hume Pipe Company.

"present in the streams flowing through the cleared portion of the valleys, but not in those parts where the streams remained covered with a thick growth of bushes" [3]. Dr. Fletcher, a member of the committee, confirmed Pratt's discovery, and in a letter to the chairman of the committee he stated: "These facts demonstrated the great danger of clearing jungle, unless it is possible at the same time to convert these streams into regular channels with cleanly-cut sides, preferably of cement or brick" [3].

In 1908 the committee furnished a detailed report and submitted a scheme of drainage to cost 27,585 dollars, and also asked for an annual grant of 2,000 dollars for upkeep.

The findings of the committee were so at variance with the views then existing that little credence was given to the discovery of Pratt and Fletcher.

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only necessary to allow the jungle of the ravines to remain to prevent malaria, and also that if the ravines were cleared it was necessary to put the water underground.

In 1910 and 1911 further sums of money were voted and more work was carried out by the Public Works Department, some controlled by entomological observations and some not. On the whole the results were bad and in 1911 malaria was still increasing.

In 1911 the Principal Medical Officer, Federated Malay States, recommended to the Government the appointment of a standing committee, pointing out that in the attempts to control malaria there had been a division of responsibility and lack of thoroughness and that unsuitable methods had been employed.

The Government approved the suggestion, and thus the Malaria Advisory Board came into existence. Under the guidance of this board, which consisted of civilians, medical officers and an engineer, work was carried out during the next two years, and in 1913 the European area was free from malaria and has remained so since. In his report for 1913 the Health Officer of Kuala Lumpur, discussing malaria, said: "The great drop in the death-rate for this disease must be attributed to the extensive drainage operations which were undertaken by the Malaria Advisory Board to get rid of the breeding places of malaria-carrying mosquitoes. Valleys which were teeming with maculatus larvæ are now bone-dry" [3].

The success attending the efforts of the Malaria Advisory Board was so marked that it has been retained ever since and its scope has been extended. In addition there is now an anti-malaria engineer for the F.M.S. who controls and supervises all new schemes, and who from a central position is able to collect and distribute information regarding new methods of prevention. There is also an anti-malaria medical officer who works at the Malaria Research Bureau at Kuala Lumpur with the Government entomologist, and who is also in close touch with the anti-malaria engineer. At smaller stations engineer and medical officers tackle all major anti-malaria problems together.

Up to the end of 1917 the Malaria Advisory Board had expended in Kuala Lumpur alone 183,971 dollars on new work and 59,230 dollars on maintenance. They had put in 65 miles of subsoil piping, 8½ miles of open masonry channels and 12 miles of open earth channels. Since then the work has been almost doubled.

Singapore.—While all this was happening at Kuala Lumpur work was being gradually extended throughout Malaya. In 1911 Singapore suffered severely from malaria and Sir Malcolm Watson was asked to recommend measures to improve the situation. An anti-malaria committee was formed and under its supervision work was started. The effects of the work were noted immediately in the spleen rates of the school children, the results in two of the drained areas being as follows :—

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TABLE I.

District	Spleen rates 1911	1914
Telok Blanagh	48·6	3·7
Kampong Jago	29·5	6·5

Since this initial success, up to the present time, the work has been extended and the Singapore municipal area is now practically free from malaria. An excellent example of the efficiency of the work is brought out by the malaria figures for British troops stationed in Singapore; since 1925 no cases of malaria have been contracted amongst the troops in Tanglin Barracks. In pre-war years malaria was always present.

Another interesting example can be found in the history of malaria on Blakan Mati, an island in Singapore harbour which is War Department property. During the war, Dr. P. S. Hunter, the Municipal Health Officer, Singapore, was mobilized for duty with the R.A.M.C. and, being stationed for a time at Blakan Mati, he undertook the task of reducing malaria.

In 1915 he submitted his scheme which was approved, and the work was carried out during 1916 and 1917. The success of the work is apparent from the following table showing the admissions for malaria.

The number of troops stationed on the island has varied very little during the period under review; if anything, the garrison has tended to increase.

TABLE II.—Blakan Mati—Singapore—Admissions for Malaria.

Year	Admissions
1912	163
1913	94
1914	48
1915	87
1916	23
1917	26
1918-1924	No figures available
1925	3
1926	10 (7 directly traceable to new work and jungle cutting)
1927	4
1928	2 (probably contracted outside the island)

The reduction in 1913 was due to the evacuation of certain forts in a heavily infected area, the equivalent of "cold storage" [4].

In 1921 intensive efforts were started in the rural area of Singapore to reduce the incidence of malaria, and the spleen rates tabulated below show what remarkable results can be achieved in a short space of time by "species sanitation" [5].

TABLE III.—Spleen Rates—Rural Singapore.

District	1921 Population	1921 Spleen rates	1926 Population	1926 Spleen rates
Bukit Timah and Mandai ..	9,500	39·6	11,240	3·6
Pasir Panjang	8,000	5·5	8,855	3·4
Seletar and Thompson Road	7,812	9·1	8,922	·08
Paya Lebar	14,991	26·3	13,675	1·02
Siglap	12,690	3·4	19,293	1·8
Woodlands	400	62·5	460	7·3

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Many further examples could be given of the remarkable results obtained in Malaya, but this hardly seems necessary in view of the resolution passed at the Congress of the Far Eastern Association which is quoted above.

The foregoing has been briefly an account of the evolution and success of permanent anti-malaria drainage, but whilst this progress was being made much work was being done in other directions, mainly of an anti-larval character. An exception, however, which saved innumerable lives and enabled many miles of country to be opened up, seems worthy of note. During the investigation of malaria on the coastal plains, where malaria is carried by *A. umbrosus*, and where many estates were being opened up, Sir Malcolm Watson noticed that by placing coolie lines in the cleared areas at a distance of half a mile from the uncut jungle the health of the coolies immediately improved and malaria practically disappeared.

Research into the habits of Malayan mosquitoes and preventive measures have been going on continuously. And since the war propaganda has been wide, circulars have been issued in all the languages in use in the country, lectures and demonstrations are continually being arranged, and by means of travelling motor dispensaries many cases of malaria are treated. The result has been the growth of an "anti-malaria mindedness" throughout the country, which is increasing from day to day. No new work is now undertaken without adequate arrangements being simultaneously made for anti-malaria measures, and these whenever possible are of a *permanent* nature.

The result of all this work has been the opening up of vast tracts of hitherto forbidden land, the saving of thousands of lives and dollars, and of necessity a tremendous improvement in the general economic condition of the country. Millions of dollars have been expended on this work, but they have been returned a hundredfold.

Part II.—Anti-Mosquito Measures.

"Species sanitation" is, at present, the keynote of the anti-malaria measures, for with few exceptions the anti-mosquito measures are entirely confined to controlling the breeding of the three mosquitoes which are the chief carriers of malaria in Malaya, the destruction of other mosquitoes being as a rule purely incidental.

Early in the anti-malaria campaign in Malaya, *Anopheles ludlowi*, *A. umbrosus* and *A. maculatus* appeared to stand out as the probable carriers of malaria, and subsequently an extensive study of the habits and distribution of all the known Malayan mosquitoes has confirmed this.

The fact that these three mosquitoes are confined to three more or less distinct zones has done much to help the problem of combating them.

In the mangrove zone which consists of mangrove forest, *A. ludlowi*

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flourishes. *A. umbrosus* is also found in this zone and more inland in the coastal zone. *A. maculatus* is practically confined to the inland zone.

There is a considerable amount of overlapping in the distribution of *A. ludlowi* and *A. umbrosus*, but, as good drainage and clearing removes both insects, this does not matter very much. It is fortunate, however, that the distribution of *A. umbrosus*, does not extend into the inland zone, where *A. maculatus* can be controlled by leaving the jungle-covered ravines untouched. When it is necessary to clear them extensive drainage is always undertaken.

The Mangrove Zone.—As already stated, this consists of mangrove forest, and it can be roughly subdivided into two smaller zones. One, nearest the sea, is covered twice daily by the incoming tide and is free

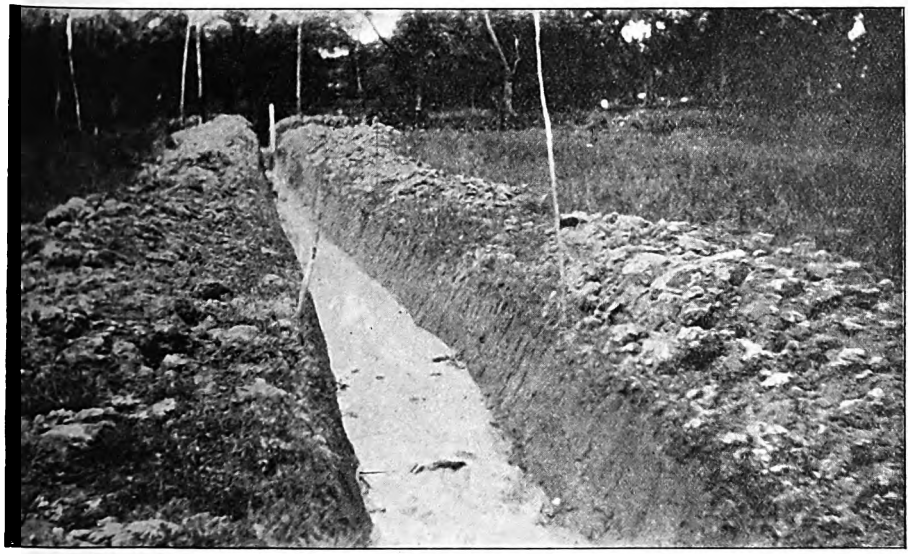


FIG. 5.—Part of valley in fig. 4. Earth drain dug down the centre.

from malaria. The other zone, further inland, is covered by the sea at spring tides for a few hours every twenty-nine days. In this zone many breeding places exist owing to the formation of pools by fallen trees and by mounds made by crabs. Immediately following a spring tide the water in these pools is sea water, but tropical rains and seepages quickly reduce the salinity of the water and render it suitable for mosquitoes to breed in. In the virgin state *A. umbrosus* is found in this zone, but if for any reason the jungle is cleared *A. ludlowi* makes its appearance.

When this inner zone is cleared of jungle the work of controlling mosquito breeding in it by temporary measures may be exceptionally difficult, owing to the very great thoroughness necessary to reach all the breeding places, and it is much more satisfactory to employ permanent measures.

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Temporary measures consist of completely clearing, levelling, draining and oiling; occasionally it may be possible, by removing obstructions, to admit the sea at every high tide.

Permanent measures consist in clearing and filling, or completely shutting out the sea by means of bunds and by putting in clean open drains in which sluice gates are fixed (figs. 1 and 2).

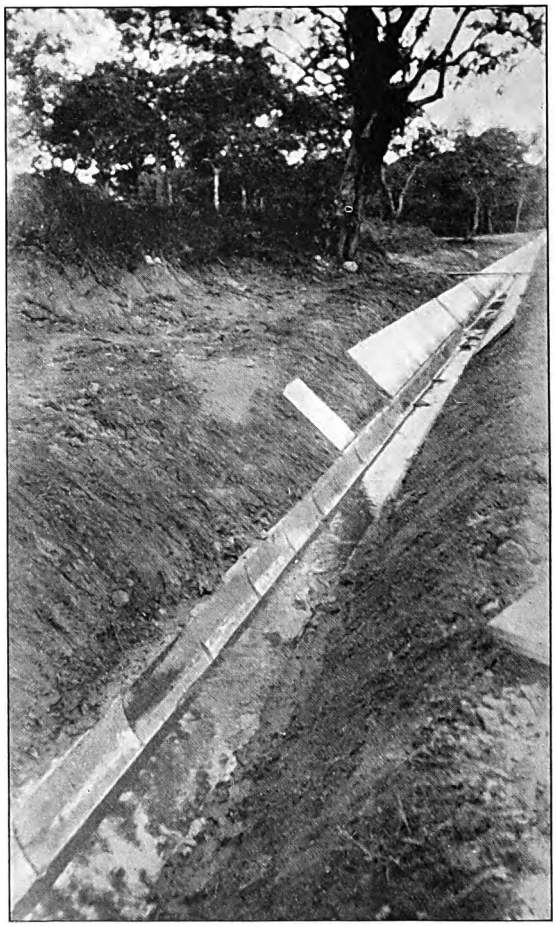


FIG. 6.—Earth drain partially completed with inverts and slabs.

When building these bunds, it is possible by placing the sluice gates at low tide level to reclaim land in the outer zone, and in this way while preventing malaria to add useful land to the area of an estate.

It was work such as this that was undertaken at Port Swettenham in 1902, and which enabled the port to be developed free from malaria.

The Coastal Zone.—This zone may also be subdivided into two zones—the coastal plains, which consist of flat land covered by dense jungle in

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which the ground water is permanently above the surface level, and the coastal hills which are low jungle-covered hills lying in an intermediate position between the coastal plain and the inland hills.

In the coastal plain *A. umbrosus* flourishes, whilst it is also present in the coastal hills as long as they are covered with jungle. *A. umbrosus* can be banished from the coastal plains by clearing; if, however, clearing is carried out on the coastal hills *A. umbrosus* is driven out, but *A. maculatus* immediately appears to takes its place, as it finds a suitable breeding place in the streams running between the hills. It is thus necessary to be prepared to carry out "anti-maculatus" measures when these hills are cleared.

Many of the original rubber estates in Malaya were situated in this coastal zone, and although the health of their labour forces was excellent on the flat lands following clearing of the jungle, the same could not be said of the hilly portion of their estates, and it was not until 1911, when burying of the streams running between the hills was recommended by Sir Macolm Watson, that the problem was solved.

In both situations while clearing was in progress the coolie lines were placed at least half a mile from the uncut jungle. This had the effect of reducing the malaria to a minimum.

In the plain zone, when the jungle is cleared, it is of course necessary to lower the level of the ground water, and this is done by means of earth drains, the sides of which are kept clean and trimmed. Concrete drains are also used, but in unfrequented rural areas they are not necessary. Levelling of the intermediate areas is necessary to remove any pools that may exist. Oiling is employed as a temporary measure.

The Inland Zone.—This zone comprises the main portion of the Malayan Peninsula. It consists of hilly undulating jungle-covered country which runs from the central range of mountains, the backbone of the peninsula, to the coastal hills. In this zone *A. maculatus* reigns supreme, *A. umbrosus* being rarely found and *A. ludlowi* never. But *A. maculatus* is only discovered when sunlight has access to the breeding places.

As has already been stated, in the history of anti-malaria measures at Kuala Lumpur and in the coastal hills, *A. maculatus* was suspected to be the carrier in the ravines from an early date, but it was not finally accepted as such until 1911, when the work of draining these ravines was started in Kuala Lumpur and Singapore, and by Sir Malcolm Watson in the coastal hills. The importance of the observations of Pratt, Fletcher and Wellington that this mosquito did not occur in the ravines until the jungle was cleared was not fully realized until 1913, when it was confirmed by Dr. Strickland. But it is now a well-recognized rule throughout the country not to disturb the jungle unless anti-malaria measures can be undertaken. *A. maculatus* is not confined to the ravines, but appears throughout the country in any clean running water to which sunlight has access. Even the smallest seepage may be responsible for outbreaks of malaria. These seepages may

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occur in the most unlooked-for places, and even in drained areas it is necessary to keep a strict watch, particularly in very dry weather. An interesting example of this is reported by Dr. P. S. Hunter from Singapore. Two small reservoirs had been built by bunding across a ravine; they were fed by water collected in subsoil drains higher up the ravine, the water being led into the reservoirs over a spillway. The floor of the reservoirs was the sloping bottom of the ravine. During a spell of dry weather the level of the water in the reservoirs fell and the floor was thus exposed. In this exposed part numerous springs appeared as small trickles of water. *A. maculatus* was present in these springs. The trouble was overcome by excavation and rough concreting down to the water's edge.

A. ludlowi and *A. umbrosus* are now easy to control, but with



FIG. 7.—Earth drain completed with inverts and slabs.

A. maculatus the situation is more difficult, and it is for this reason that so much time and money have been expended in evolving preventive measures.

With several different authorities carrying out this work certain differences have arisen in its execution, but the principle in all cases has remained the same, i.e., the removal of the breeding places by permanent measures where possible. This is done by controlling all surface water in subsoil drains or concrete surface channels.

In the F.M.S. the whole of the subsoil water is controlled by subsoil pipes, and then led away by large central subsoil pipes or solid concrete channels. Before the work is commenced the land is surveyed and the course of the pipes and the size required are plotted on a map.

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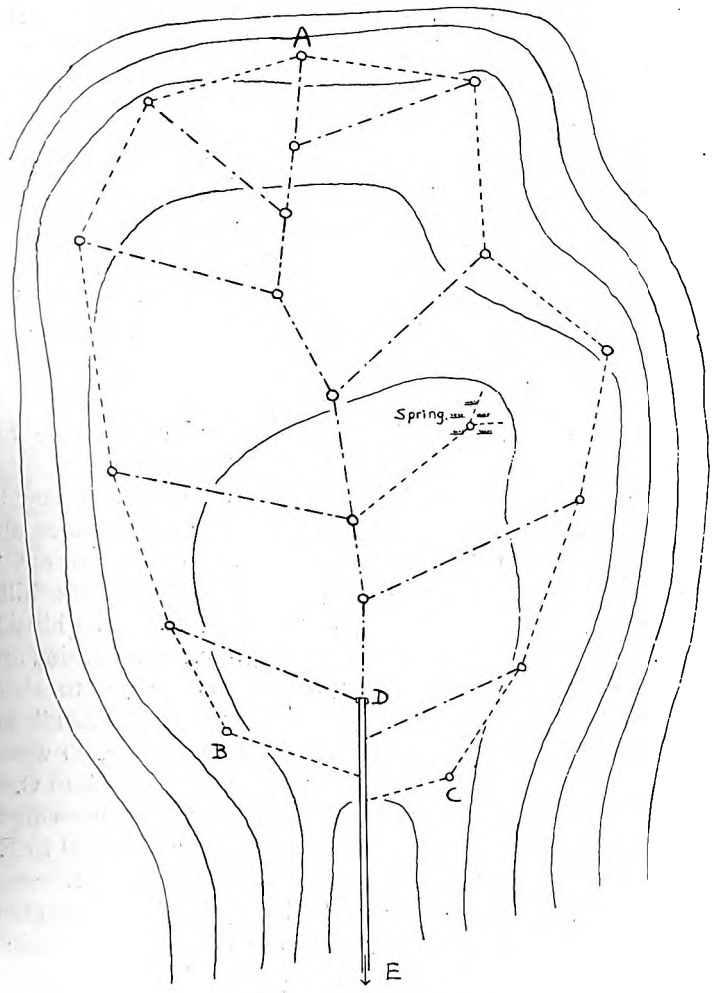


FIG. 8.—F. M. S. system.

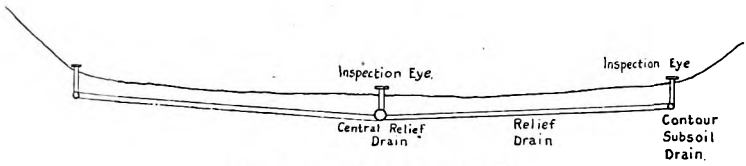


FIG. 9.—Section in area A-D.

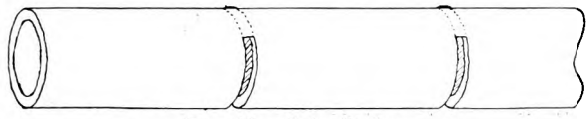


FIG. 10.—Subsoil pipe.

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In the Straits Settlements, with the exception of the municipal area of Singapore, similar work is carried out, but, instead of a solid channel, the central drain is made of concrete sections three feet long, which are laid about one-half of an inch apart (figs. 3 and 12).

In the Singapore municipal area deep central drains are used to carry off the water as far as possible, and subsoil pipes are only used to tap water not caught by these (fig. 11).

The method employed is to dig deep earth drains down the centre of the area to be drained and to observe the effect over a period of about three months, deepening further if necessary. At the end of this period the central drain, if found adequate, is completed by the use of concrete sections, as described in the Singapore rural area.

In all cases it is necessary to legislate for wet weather, and this is particularly so in the type of the work carried out in the Singapore municipal area.

The F.M.S. system of drainage is shown in figs. 8 and 9, which represents a rough contour map of a valley with steep sides and a flat swampy bottom. The dotted lines A to B, A to C, represent "subsoil contour drains." These are laid at varying distances up the hillside and should be deep enough to catch all water coming down the hillside before it can find its way on to the surface of the valley. The drains are laid in straight lines and inspection eyes and relief drains are put in about every fifty yards, or oftener if necessary. Drains "chain-dotted" are relief drains; these are not primarily intended to catch water, all water except deep springs being caught by the contour drains A to B, A to C. Special subsoil drains are employed when necessary to control deep springs. From A to D the central relief drain is a subsoil pipe, but from D to E it is an open concrete channel cast *in situ* with turfed banks above it.

The central drains in this system need only be deep enough to carry off the water from the contour drains. In the deep central drain system, used in the Singapore municipal area, however, the depth is a matter of primary importance in order to bring the subsoil water level as low as possible and avoid the necessity of laying subsoil pipes. This is particularly so in flat areas.

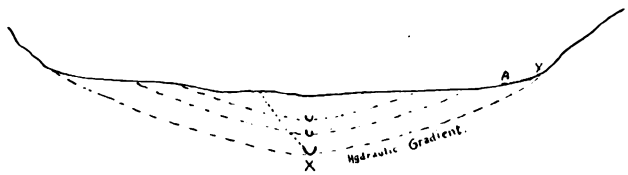


FIG. 11.—System employed in Singapore municipality.

This drawing shows a cross-section of a similar valley to that shown in fig. 8, and demonstrates the effect of deepening the central drain on the "hydraulic gradient." The lowest drain dries up the valley as far as Y and does away with the seepage at A, which was unaffected by shallower drains.

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The deeper the drain the larger the area drained; the nature of the soil, of course, causes modifications and subsoil pipes are employed when necessary.

These earth drains are observed for a time and, when found to be satisfactory, are completed in the same manner as in the Singapore rural area (fig. 12). The advantages claimed for this method are that it saves expense, labour and upkeep. It is necessary, however, to keep a strict watch on the drained area and to be prepared to put in subsoil pipes should seepages appear.

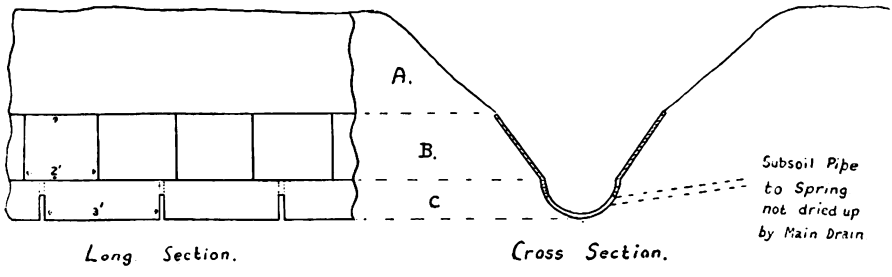


FIG. 12.—Singapore central drain.

Figure 12 shows in longitudinal and cross-section the method employed in the Singapore area.

The system is a combination of the two methods already described. The subsoil water is mainly controlled by subsoil pipes, but the central drain, while laid at a greater depth than in the F.M.S., is not so deep as in the municipal area of Singapore. By leaving gaps between the sections of pipe forming the drain water finds its way into it from below. The drain consists of three areas: (*a*) earth sides, grassed; (*b*) concrete slabs, two feet square; (*c*) half sections of spun concrete pipes, three feet long, manufactured by the Hume Pipe Company (fig. 3).

In making these drains an earth drain is dug down the centre of the area to be drained, and then the half sections of pipes "inverts" are laid about half an inch apart. They are cemented together in their upper third only and water can thus enter the drain from below; sometimes a layer of broken brick or small stones is placed underneath; this depends on the soil. Area B consists of concrete slabs, two feet square, cemented together and to the top of the inverts. These always have a layer of broken brick or stone behind them. If this is not done water may collect there and gradually force its way over the top, forming dangerous seepages. The broken brick allows it to make its way down and find its way into the drain from below. Area A is the top of the original earth drain on which sods have been laid. It is found that once the sods have "taken" the area can withstand any rush of storm water that may occur. Subsoil pipes are laid as in the F.M.S., and relief drains join the central drain at intervals.

"Weep-holes" are now rarely employed in these central drains, as

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A. maculatus has occasionally been found breeding in them. If they are necessary great care must be taken to prevent pockets forming in the earth behind the slabs.

Subsoil Drains (fig. 10).—These are made with ordinary baked clay agricultural pipes. They vary in size from three inches in diameter to one foot. If bigger pipes than this are required spun concrete pipes are generally used. Before the pipes are accepted from the makers a very close inspection is carried out to exclude pipes that are at all misshapen, as experience has shown that distorted pipes very often collapse and cause blockage of the drains. The pipes are laid about one inch apart, and a minimum depth of five feet is aimed at to prevent damage by roots. Until recent years the junction of the pipes was left uncovered, but experience has shown that silting up occasionally occurs through soil entering the drains from above. It is usual now to cover the upper third of the gap between the pipes; this prevents soil entering the drain and allows the water to enter from below. Various substances are used for covering the junctions—palm leaves, broken pipes, clay, etc. Inspection eyes are placed at intervals of about fifty yards, and at all junctions or bends. These inspection eyes are formed by placing subsoil pipes end to end vertically and covering the top with a concrete slab.

Maintenance.—This is just as important as the primary drainage, and it is necessary to have ample funds available in order to carry out repairs as they become necessary, to add new drains if required, and to allow of frequent inspection of drained areas and cleansing of all open channels.

Inspection of all drained areas is carried out at least once a month. In Kuala Lumpur it is done weekly. All open channels must be kept free of weeds, particularly in dry weather, as *A. maculatus* will breed in concrete channels if weeds are allowed to grow in them and heavy rainfall does not flush them.

The grass in all drained areas must be kept short, for if this is not done "lalang" grows rapidly, and its roots cause blocking of the subsoil drains; for the same reason trees and jungle are not allowed within twenty feet of drained areas.

While the harnessing of the subsoil water has been in progress many ingenious methods of utilizing it for the community have been evolved.

Subsoil water is used to provide drinking and washing water, to supply dhobie ghats, and to flush latrines, etc.

Conclusion.—In a brief account such as this, adequately to describe the work that has been done in combating malaria in Malaya is impossible, and no mention has been made at all of the excellent rural sanitation which is to a large extent dependent on this work. To those who would know more, Sir Malcolm Watson's book, "The Prevention of Malaria in the Federated Malay States," from which I have quoted freely, is recommended. Much valuable information is also to be found in "The Engineer and the Prevention of Malaria," by Henry Home. One point more than any

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UNSUCCESSFUL DRAINAGE AT LYMEUN, HONG KONG.



FIG. 13.—Solid concrete drains with weepholes. Herring-bone system. *A. maculatus* was found breeding both in the drains and all round them. A single deep central drain would have dried this area almost completely.

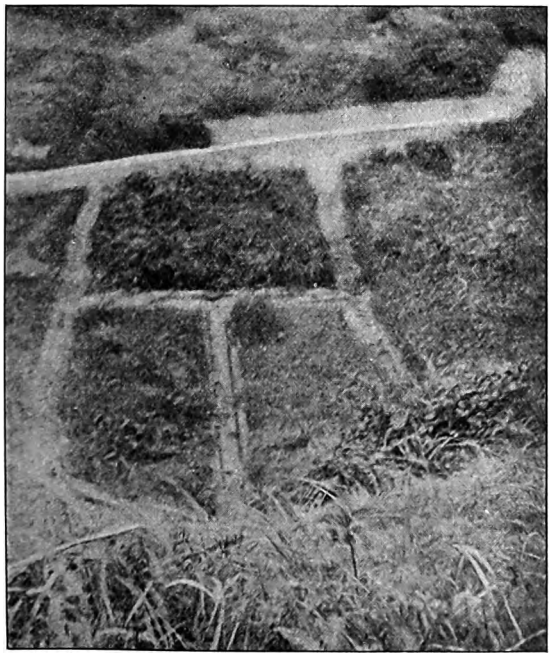


FIG 14.—Further attempts at anti-maculatus drainage with solid concrete drains. Unsuccessful. A single contour drain would have dried this area.

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other which needs emphasizing is the necessity of employing engineers on anti-malarial work, and of having between these engineers and the anti-malaria medical officers the closest co-operation.

At Lymeun Fort, in Hong Kong, an extensive system of drainage intended to be "anti-malarial" has been made in the past, but owing to the nature of the drains, i.e., solid concrete on the herring-bone system, they have made matters worse by holding back the subsoil water and forcing it on to the surface. *A. maculatus* was found breeding extensively all over the drained area and in the drains (fig. 13). Had the results of the drainage been checked by an entomologist or by an engineer officer with a knowledge of the habits of *A. maculatus*, the situation noted would never have arisen. In addition to co-operating with the anti-malaria medical officers, it is imperative that the engineers should realize that unconsciously they may, in the course of their work, be forming breeding places. If the engineers take the anti-malaria medical officers into their confidence endless work and anxiety may be saved.

Continuity of supervision is another essential factor for success, and in consequence in the Army, where moves may be frequent, the formation of anti-malaria committees is important, both for the supervision of work and the preservation of records.

In conclusion, I have to thank Lieutenant R. A. Laurence, R.E., for the drawings for these notes and for suggestions in the text.

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RING UP THE CURTAIN!

By U. P. A.

(*Continued from p.* 39.)

Each day fresh falls of snow occurred. The land remained in the grip of King Frost. Influenza continued to rage and to spread. We took our seats in a super-heated, westward-bound train.

It is a pity that Georgina is not in the Diplomatic Service. She has an insatiable thirst for knowledge, she invites confidence, and her knack of making friends with perfect strangers in a minimum of time and with a maximum of cordiality is, I am sure, much appreciated by all with whom she comes in contact.

Georgina does not believe in supporting the tedium of a grey existence. If you are bored, it is your own fault. Life is full of interest and novelty, provided you take the trouble to scratch below the surface.

A shabby little man buzzed like a bluebottle in the corridor, and made several ineffectual attempts to plant himself and his numerous packages in our coupé. He looked at me suspiciously, and at Georgina trustingly.

I glared.

Georgina smiled.

"Why does he not go away?" I said. "There is no room here."

"I think he rather likes me."

"You?"

"Yes. He is Yakub Schnellwützski, a Polish merchant in a large way of business. Thrilling!"

"How do you know that?"

"He told me all about it at the bookstall. He sells eggs—mountains of them."

I sniffed.

"Oh, you are quite wrong, as usual. Not just a few eggs for the suburban breakfast table, but thousands of eggs every day, for every conceivable purpose, in every quarter of the globe." Georgina became confidential; she whispered: "Guess where he is going now."

"How could I? Commercial Road, probably."

"Gracious—how clever! How did you know? Yes; and he is negotiating a contract for millions of eggs at 0·2168 of a penny per egg f.o.b. West India Dock. Tons of money in it, only—you must not tell anybody."

"Georgina—do you realize that you render yourself liable to fine and (or) imprisonment if you do not at once send this important information to the Food Council?"

"You mean the people who tell the Director-General to reduce your

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pay because of the colossal fall in the cost of living? Then I shall go to jail—and gladly. Besides, Yakub says that, if I can do anything for him in 'Pindi or Lahore—he has already cornered Calcutta and Bombay—I shall have as many eggs as I like for 0.2168 of a penny each." She added thoughtfully: "I wonder what the khansamah would think of that."

I began to feel anxious. "Are Polish eggs fresh eggs?" I asked.

"I'm not quite clear on that point—not yet; but I shall know all about it before we reach Munich. Yakub has three or four dozen samples in his greatcoat pockets."

"You can sample them in the corridor, not in here. I won't have his eggs here—no—not even if he were Marshal Pilsudski himself."

"Huh! Just like you. Fresh or otherwise—if only you would show more interest in eggs f.o.b. West India Dock, and less in the latest regulations about leggings and silly things of that kind, we might now be retiring in affluence, instead of spending our extreme old age in chasing phantom colonelcies—or whatever your next step isn't going to be."

I changed the subject; and eventually the man from Poland betook himself and his eggs elsewhere.

The way lay through the best type of scenery in this part of the world—forest-clad hills.

Twilight was approaching as we passed through Salzburg. The old town looked lovely under its snowy mantle, coloured by the last rays of the setting sun.

On arrival at Munich we put up at the Deutscher Hof, where we were as well looked after as circumstances would permit. It is a comfortable hotel, with an excellent cuisine and an attentive staff. But at that time Munich was suffering not only from snow, frost and influenza, but from Carnival too; and, of course, the hotels had to bear the brunt—to the great satisfaction of their proprietors and the discomfort of a proportion of their guests.

If you go to Munich at Carnival time you must live in fancy dress, consume an inordinate quantity of alcohol (without becoming intoxicated), dance till the milkman arrives and rise for "the five o'clock." Otherwise you will be regarded as a freak: you will live a hand-to-mouth existence, and tire yourself out in trying to induce somnolent waiters to fetch a meal from the demoralized kitchen.

From 5 a.m. to 5 p.m. the caterers of Munich, and their staffs, lie flat on their backs, exhausted. From 5 p.m. to 5 a.m. they fly around, flurried and frenzied; and it needs a Bavarian-Mexican cow-puncher's gun, or a Bavarian-Batavian cannibal's club, to procure anything more substantial than a pint of Pilsener.

What a life!

Even "the five o'clock" was a struggle, for from 3 p.m. to 7 p.m. the hotel was stormed and held by four or five hundred children, attended by

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proud fathers, adoring mothers and troops of fond relations. They all danced, ate tons of creamy cakes and swallowed gallons of milk and chocolate. They chattered incessantly, but they did not laugh much, nor romp: they behaved decorously and, no doubt, enjoyed themselves in a well disciplined manner. The comparative absence of noise was astonishing but oh—the heat and the squash!

Worse still—a good deal worse—were the conditions from 7.30 p.m. onwards. If "the five o'clock" was a struggle, dinner was a dog fight, and supper a bear garden. Adult carnivalists invaded the hotel, ate prodigiously, drank enormously, danced indefatigably and had a good time generally, with that thoroughness and determination characteristic of the German people.

They got their money's worth.

And oh—the stuffiness and crush!

One would not look at the Carnival through jaundiced eyes; but it is a form of entertainment which is all very well—now and again. It should be taken occasionally and in moderate doses. When it is administered in heroic dosage over a week, or more, none but a Teuton can stand up to it. It is not so much the concentration as the prolongation that wears you out.

The festival was initiated by a grand street procession, in which the heavy Westphalian horses, and the bands, carried off the honours. With certain striking exceptions, the dresses of the ordinary carnivalists were neither attractive nor original. Colour schemes were crude, especially by daylight; also, extreme modernism was too much to the fore, and too often coupled with sheer vulgarity. Epstein's "Day" is bad enough in stone: imagine the ghastly thing in flesh and blood—ugh!

Mention must be made of Frau Fritz's and Fräulein Gertrud's legs. They were prominently displayed, and to a maximum extent, irrespective of circumference or shape. The result was seldom as happy as their proud owners believed: we were afforded ample opportunity of noting that, in Munich, there are a few good legs, some bad legs, and thousands of legs.

There is a good deal to be seen in Munich. The former Royal Palace is particularly fine. Do not "lunch in the famous old Hofbräuhaus at the Platzl, Munich's best known beer 'keller'" as the guidebook advises you to do—unless you are an Extreme Left proletarian.

We were engaged on our usual sketchy round of museums, galleries and churches, perhaps with less enthusiasm than usual—an end-of-the-session frame of mind—when, suddenly and unexpectedly, we discovered something superlative.

The Deutsches Museum.

In our experience quite unique, altogether admirable, and as nearly perfect as one has any right to expect in this very imperfect world.

We had been strongly advised to visit this institution, but this frightened us:—

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SECTION A.--Mining, metallurgy, power-engines.
B.—Transport by land, road building, railway and tunnel construction, bridge building, ship building, aeronautics, aerostatics, meteorology.
C.—Mathematics, physics, chemistry.
D.—Buildings and building material, lighting, heating, gas and water supplies, electrotechnical appliances.
E.—Astronomy, textile and paper industries, printing, agriculture, brewing, distillation.
F.—Library, 100,000 volumes.
Bookstall, reading room and restaurant.
Entrance fee, 5d.

Dismal and dreary. Yes—it frightened us. You know : exophthalmos, retroflexion of the neck, tonic spasm of the lumbar musculature, flat foot and cerebral exhaustion. Museumitis.

However, the hall porter of the Deutscher Hof shamed us into going ; and, after that, we practically lived in the place.

It was founded by Dr. Oskar von Miller in 1903. Collection and arrangement, etc., of the exhibits were delayed by the war. An initial opening ceremony took place in 1921 and, in May, 1925, the completed museum was formally opened.

The main building is constructed of reinforced concrete, with a tower 200 feet high. The flooring covers an area of nine acres and, if you wish to see everything, you have to pace the galleries for a distance of nine miles. "If you are pressed for time, you should first view the sections you are most interested in, as otherwise the huge amount seen might possibly impair your receptive capacity."

Naïve, but true!

Bulk, acreage and distance are repellents.

In what respects, then, is this museum unique, admirable, nearly perfect?

To answer this question would need more leisure and ability than I possess, even if you had time and patience to read. Briefly—success is not dependent on the number and variety of the exhibits, but on the manner in which they are shown. That is the secret. Go to Munich and see for yourself : you will not be disappointed.

A truly great and intensely interesting show.

The Opera House is designed on severely simple lines. The curtains, paint work and furnishings are decidedly shabby and, in general elegance, the interior is not to be compared with the opera houses in Dresden, Vienna or Prague. The programmes were suffering from Carnival, and the artistes from influenza. However, in Munich we did come across a pleasing phenomenon which we had not encountered before, and have not met with since. This was a good tenor who was clean, young, slim and handsome, and who could act well. Of course, he was not the Opera's leading tenor; but, perchance, he may be promoted some day, and before he develops a

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blue-black chin, embonpoint and a stereotyped style: in fact, before he becomes eligible for a major's maximum pension. For that happy consummation we wish him good luck, although, under the circumstances, we are putting no money on his chances.

The Bat was our first piece. This is a popular comic opera by Johann Strauss. It is amusing and tuneful; but, when you hear an opera of this kind on the Continent, you are sure to compare it with its British prototypes—the operas of Sir Arthur Sullivan and Sir Edward German.

In making such a comparison you must consider the score alone: you cannot pass an adverse judgment on the libretto unless you have an intimate knowledge of German. But, libretto apart, there is no doubt that *The Bat*, and operas of its kind, are not in the same class as the Savoy fare, or *Merrie England*. Perhaps Donizetti's *Daughter of the Regiment* is an exception; but it is neither German nor Austrian.

However, with these opinions Fritz probably would not agree.

The Bartered Bride—another of Smetana's rural Bohemian compositions—was very good. It was well staged, the chorus was excellent, and the engaging young tenor once again charmed the ear and pleased the eye.

This opera makes no pretence at seriousness; but as it is based on the quaint customs of a simple-hearted, freedom-loving mountain race, it proceeds with a freshness and vigour which are absent from the "Bohemianism" of the towns, so often depicted in the more ambitious operas.

Smetana's work never reflects the tragedy of his life.

Charles Annesley's "The Standard Operaglass,"[1] introduces *The Magic Flute* thus:—

> *The Magic Flute* is one of the most remarkable operas known on the stage. It is half fictitious, half allegorical. The text, done by the old stage-director, Schikaneder, was long mistaken for a fiction without any common sense; but Mozart saw deeper, else he would not have adapted his wonderful music to it. It is true that the tales of old Egypt are mixed up in a curious manner with modern freemasonry, but nobody, except a superficial observer, could fail to catch a deep moral sense in the naïve rhymes.

The paragraph is quoted in full, because it is typical of the literature which deals with the *The Magic Flute*. The more people write about it, the less do they—and their readers—make of it. All these so-called explanations are futile: they mean nothing at all, for the very good reason that, so far, the book of this delightful opera has remained a complete enigma. It is absolutely inexplicable; and "the tales of old Egypt," "modern freemasonry" and a "deep moral sense" are just three little red herrings drawn across the trail.

[1] German edition.

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What is the trail? On this, at least, everyone agrees: That the genius of Mozart negatives the possibility of his music being wedded to rubbish: there must be some meaning in the plot, some sense in the lines.

Firmly convinced of this truth, and profoundly dissatisfied with partisan explanations-at-any price—not one is even plausible—I took the trail. I admit that I took it with temerity and misgiving; but I worked hard, and I venture to think that, at last, I have solved the mystery of *The Magic Flute.*

Fiction and freemasonry? Egyptian and moral? Bah! It is none of these things.

It is a plain, straightforward tale told, like the "Pilgrim's Progress," in pure, easily understood allegory.

Here it is as I see it (not copyright.)

THE ORIGINAL.	VERSION U.P.A.
Title.	
THE MAGIC FLUTE.	THE MAGIC MICROSCOPE.
Characters.	
Prince Tamino.	Captain Tamino, M.C., R.A.M.C.
Queen of Night.	The Colonel's Lady.
Princess Pamina.	Pam, the Colonel's daughter.
The High Priest Sarastro.	Micrococcus Sarastroysis.
Papageno.	Lieutenant Papageno, R.A.M.C., T.C.
The Queen's Ladies.	Members of Q.A.I.M.N.S.
Monostatos, the High Priest's servant.	Coccus Sarastroysoid.

The lovely and utterly adorable Pam is striken nigh unto death.

She is suffering from that terrible, because hitherto-incurable malady, Sarastroysis.

Pam's mamma, the Colonel's Lady, is beside herself with grief. She is distraught, demented, down and out.

Captain Tamino, M.C., R.A.M.C., is posted to the station from the Senior Officers' Course, Millbank. On the strength of a 60 per cent. pass, he at once applies for 30 days' leave.

The Colonel's Lady hears of the gallant Captain's arrival, sends for him, and implores him to save her darling Pam.

Capt. T.] "Delighted, I'm sure; but I have just put in for 30 days' leave."

The Col.'s Lady.] "If you cure my little daughter you shall have 61 days' leave. I swear it."

Captain Tamino makes a mental note of this, and returns to his quarters for the purpose of consulting his College notes on bacteriology. He finds that the professor has been rather vague on the subject of Sarastroysis.

Enter Lieutenant Papageno, R.A.M.C., T.C. He is in trouble. It appears that, although he has been in the station for six weeks, he has not yet called on the Nursing Sisters' Mess. It is also alleged that he ordered the ward-master to see to it that Private Doolittle received his dose of Mist. Alba, t.i.d., p.c. This, however, is mere idle gossip. Nevertheless, the Members, Q.A.I.M.N.S., have publicly announced their intention of having nothing to do with Lieut. Papageno. A resolution to that effect was entered in the minutes of the last Mess meeting.

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Tamino prevails on Papageno to send to the Matron a written apology. The amende honorable is very well received and, at the usual Sunday afternoon tea-party, the Matron and Members Q.A.I.M.N.S. present Captain Tamino with a gold-mounted all-glass syringe: Lieutenant Papageno with an electric incubator: and both with a magic microscope.

Papageno is, of course, full of gratitude to Tamino, and expresses a desire to render him some signal service. Tamino asks Papageno if he knows anything about Sarastroysis. Papageno says that, when he was ship's doctor on the S.S. "Grosvenor," the Clyde to Brisbane, case whisky and foundry castings, the chief engineer—McCluskie by name—suffered from Sarastroysis. Papageno adds that the disease is due to a filter-passer. McCluskie was buried at sea, fifty nautical miles east of the Straits of Bab-el-Mandeb.

Tamino begs Papageno to visit the Colonel's daughter as he (T.) is feeling indisposed.

Papageno discovers that Pam has been attacked by the giant Coccus Sarastroysoid—a sequela of the original infection, and the cause of death (secondary) in the McCluskie case.

He prepares a vaccine in the electric incubator, and cures Pam. However, in doing so, he accidentally infects himself and is put on the S.I. list. In his delirium he raves continually about the beauty and charm of the incomparable Pam.

Tamino makes a note of this. He goes to the incubator, removes the culture, examines it under the magic microscope and finds, firstly, that all the giant cocci have been electrocuted; and secondly, that Micrococcus Sarastroysis remains in pure culture.

Tamino cannot be quite certain that the organism really is the elusive micrococcus.

Also, he wants his leave—61 days, if possible.

Also, Pam is a darling.

The brave captain visits the patient at long last.

Love at first sight. Mutual.

Captain Tamino then swears the Colonel's Lady to secrecy, and tells her of his grim, heroic plan. Failing to dissuade him from his awful purpose, the Colonel's Lady breaks the sad news to Pam, who is utterly overcome.

Meanwhile, Tamino returns to the lab., fills the gold-mounted all-glass syringe with Micrococci Sarastroysis in pure culture, and administers to himself an intra-peritoneal injection.

After a suitable incubation period, he develops an acute attack of the fell malady, and is marked "D.I."

Pam, on thinking over the affair, concludes that Tamino has attempted to commit *felo de se* in order to avoid marriage. She goes into a decline.

By this time Papageno has recovered. Using his electric incubator again, he prepares a vaccine from Tamino, and thereby rids Pam of her original infection. He then discovers that the decline is functional, and not organic. He therefore hypnotizes her in accordance with the recommendations of the B.M.A.'s Committee on Psycho-Analysis, and convinces her of the pure and self-sacrificing motive by which her lover, Tamino, was actuated.

Pam nurses her captain back to health and strength, with the usual result.

After they are married they proceed on their honeymoon. The Colonel's Lady is better than her word, for she procures for our hero not 61, but 90 days' leave; and what is more, she induces the G.O.C. to sign a certificate sanctioning allowances in full.

Poor Papageno! He loses a good friend and a promising acquaintance; but he has his electric incubator; and Tamino presents him with the gold-mounted all-glass syringe, and full possession of the magic microscope as he (T.) has no further use for these incumbrances. In them the lonely Papageno finds a measure of consolation.

It is of no use saying that the story of *The Magic Microscope* is far

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too complicated for grand opera. The story of *The Magic Flute* is much more complicated.

"Two blacks do not make a white," you say.

True; but at least *The Magic Microscope* provides an intelligible story, whereas *The Magic Flute* does not.

So much for the book: what of the score?

We all have our pet likes and dislikes. I am a prejudiced admirer of Mozart and, in consequence, lay myself open to attack from every side.

To begin with, there is the man's life—a romance of music, adorned by many wonderful works of genius, and extinguished at the early age of thirty-five.

Then the music itself—always charming and cheerful: always distinguished and, like most things of distinction, always honest and pure; and the good temper and humour of it—surely Mozart is the ideal guide, philosopher and friend in the realm of harmony.

Should you say: "I cannot abide grand opera," I would ask: "Have you heard *Don Juan?*"

If you answer: "Yes," then you will never like grand opera; but if your answer is "No," then I beg you to attend a performance—a good performance—of this delightful piece as soon as you can. Do not abandon grand opera before taking my advice: ten to one that the lovable Mozart will captivate you with his *Don Juan*. Do not be discouraged on account of *Fidelio*, *Parsifal* or *Salome*: admittedly they present difficulties, at first. The only difficulty about *Don Juan* is his inability to accomplish a non-stop run. You feel desperately sorry when the curtain falls at the end of the last act.

The Magic Flute was Mozart's last opera. Although its music is beautiful, there is no doubt that, as a whole, it suffers from its alliance with its impossible libretto.

V.

Originally, we intended to stay for some time at Frankfort, where there is excellent opera. However, on our arrival there we found that all seats in the opera house were booked up for days ahead. We attempted bribery, but the box-office proved incorruptible. In this we may, in reality, have been lucky, for the cold was the most severe we had yet experienced, and a bitter nor'-easter blew fiercely and continuously throughout our short stay.

I shall never, never become an Arctic explorer.

Queer people who contemplate taking up Arctic exploration as a hobby would be well advised first to try out the idea in a hard Frankfort winter.

In default of opera, we went to the Hippodrome. It was only thirty yards from our hotel, so we were able to cover the distance before our noses and ears became frozen.

The programme was excellent, but quite different from British music-hall fare. Vocal and "patter" items were entirely absent. In fact, the

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only words spoken were a few introductory remarks—first, in English, then in French, and finally in German—by the inimitable Grock and his partner. For the rest, the bill was filled by a silent company of acrobats, equilibrists, knock-about comedians, jugglers, conjurers, instrumentalists, dancers and so on; and very clever and entertaining they were.

Georgina became excited over a four-a-side cyclists' football (or was it polo?) match, England *v.* Germany. Result: a draw: three goals apiece. After that, an equilibrist, who was attempting to balance himself on a pyramid of champagne bottles, toppled over and came crashing down from a height of about fifty feet. He almost landed in Georgina's lap: almost; that is to say, he saved himself—and her—by clutching a hanging rope at the psychological moment. Georgina screamed. The equilibrist and the audience were delighted.

Grock was the "star." His turn occupied about forty minutes—a much longer spell than when he appears on the stage in this country. As usual, he was excruciatingly funny and hopelessly idiotic. A great artist.

Frankfort Hippodrome was a pleasant surprise, as similar shows at Brunswick and Vienna had proved to be disappointing. German vaudeville is good enough in a way, but it is not a patch on the British variety. And as for cabarets and "night dancings"—well, they are not unduly expensive and they are not wildly exhilarating; indeed, they are just about as dull as an Inveraray Sabbath.

The "Rheingold Express" conveyed us along the banks of the great frozen waterway to Cologne. There we stayed at the Eden Hotel, well-known to the old B.A.O.R. This hotel, like the rest of Cologne, was suffering from the after-effects of Carnival.

As in Munich, the programme at the opera house reflected Carnival and bowed to influenza. Thus, at the eleventh hour, *Orpheus in the Underworld* took the place of *Figaro*: an unwelcome change since, in the former, Offenbach is poor, whereas, in the latter, Mozart is at his best.

For one thing, at least, we are grateful to Cologne, viz., for our introduction to *The Lowlands*, a music-drama by Eugène d'Albert.

This opera is performed regularly in Germany, Czecho-Slovakia and Austria, but it is not well known to British audiences. The story is a tragic one; the orchestration and vocal score are fine; and the Cologne company did the piece justice. The portrayal of the principal rôle, "Marta," was particularly good.

The composer of *The Lowlands* was born in Glasgow, in 1864. His music is always melodious and written to fit the action and the place. Hence, frequent use is made of Spanish rhythms and measures. Nevertheless, the composition is essentially German in character, and to Dresden is due the discovery and encouragement of D'Albert's gifts.

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Two ballets in Cologne provided interesting comparisons with the two which we saw in Vienna.

The action of *The Fairy Doll* takes place in a toyshop. The characters include the members of an English family who are, of course, mercilessly caricatured in accordance with Fritz's conception of John Bull. Both spectacle and music were charming, and the dancing was very good; but the ballet is not so brilliant, elaborate or "advanced" as its Viennese counterpart, Strauss' cream-cum-confectionery ballet.

Adeline Genée would have made a fascinating "Fairy Doll"; but then she belonged to Leicester Square, 1889, and not to the Opern Ring, 1929. Even the incomparable Pavlova might shy at the latter under certain conditions—the conditions described by Trilby as "The Altogether."

Bathyllus bore a marked general resemblance to *Joseph's Story*. It almost suggested a poor attempt at plagiarism. However, Bathyllus wore a hair shirt which had not yet shrunk to microscopic proportions; and his lady-love did not discard ninety per cent of her apparel—not publicly, at any rate—as did poor Potiphar's wife.

On the whole, *Bathyllus* was rather a crude affair; but it was neither ghastly in refinement, nor terrifying in sensuousness—and that cannot be said of *Joseph's Story* as told in Vienna.

Adolphe Adam's *Postilion of Longjumeau* ushered out our leave. This is a typical French light opera: a jolly piece in the same class as *The Bartered Bride*, *La Vie Parisienne* and similar productions.

Before boarding the train for The Hook it may be worth mentioning that Cologne Opera House is now under able, energetic and enterprising management, and is making a strong bid for eminence in the German musical world. Its efforts are attracting a good deal of attention and support and seem likely to be successful. As Cologne is so easy of access from England, this opera house should be a boon to British lovers of grand opera.

We left Carnival and influenza behind; but, on reaching home, we found every pipe frozen and had to sojourn temporarily in a hotel.

The hotel's central heating system was also frozen.

Epilogue.

There was a time when we held up German kultur to ridicule and contempt. We had to do it: it was demanded by the exigencies of the situation.

Unfortunately, the exigencies of the situation persisted too long: so long, that jazz bands and Hollywood films were enabled not only to spread their blight over our beloved land, but to become firmly rooted in the soil thereof. Being noxious weeds, they multiplied and flourished amazingly.

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On the other hand, the Central Powers were walled off. They only suffered from the tail end of the invasion. To them, Wild West syncopations and "flickers" are still incidentals, not to be taken too seriously, and certainly not for a moment to be allowed to become dominants.

Looking back, it all seems very strange: a nightmare, in which our artistic intelligence and critical faculties were warped and debased.

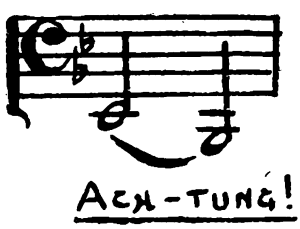
Looking forward, it behoves us to seek out the truth in these matters and, thereafter, to institute comparisons, thus:—Which is the more worthy of preference? Grand opera and all it signifies, or "The Talkies" and all they signify?

Nor do they draw the line at talking. No. Luridly, perfervidly, they beseech you to patronize the All-Singing Movietone, Fully Mechanized and in Natural Colours.

Well, well—

But, whatever they they may do, they cannot deprive us of our sense of humour. As Mr. Punch remarks: "There is much talk of naval disarmament; but what about nasal disarmament?"

The stage is dimmed. The great basso-profundo advances to the footlights. He wears a worried look. The orchestra plays the opening bars of the famous aria, "The Birth of Prohibition." The conductor raises his bâton: the basso-profundo opens his lips and begins:—



via the nose.

"What!" you exclaim—"*via the nose*? Impossible!"

It is, thank goodness.

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Editorial.

REPORT ON THE HEALTH OF THE ARMY FOR THE YEAR 1928.

On October 17, 1928, the Director-General, Army Medical Services, Lieutenant-General H. B. Fawcus, submitted the Report on the Health of the Army at home and abroad to the Under Secretary of State for War.

The year under review has been the healthiest since the Great War, the admission-rate being 426·2 per 1,000 of strength, compared with 467·7 in 1927, 454·8 in 1926, and 467·5 for the period 1923-27.

The decrease in sickness was due to a decided fall in the number of cases of influenza, malaria and venereal diseases. The principal causes of admission to hospital were: venereal disease, 7,213 cases; malaria, 6,550 cases; inflammation of tonsils, 6,110 cases. The admission ratio of malaria per 1,000 of strength was only 35·7 per 1,000, compared with 49·5 in 1927, and that for venereal disease 39·3, compared with 49·1 in 1927, while the ratio for influenza was only 8·8, compared with 24·1 in 1927.

Judged by the average sick time to each soldier, the commands with the highest ratio of inefficiency were: Iraq, North and South China, West Africa, Shanghai and Ceylon; those with the lowest were Bermuda, Rhine and Malta.

The number of invalids discharged from the Army was: 9·06 per 1,000 of strength, compared with 11·43 in 1927, and 12·15 for the period 1923-27.

The principal causes of invaliding were diseases of the middle ear and tuberculosis. As regards the former, there were only 153 cases of suppuration of the middle ear invalided, compared with 414 in 1927, though there was a slight increase in ordinary inflammation of the middle ear. There were only 98 invalids sent home for middle-ear disease, compared with 219 in 1927. Obviously the inspections of the specialist in ear and throat disease from the Queen Alexandra Military Hospital, to which we referred in last year's review, are bearing fruit. It is satisfactory to learn that as the result of his investigations it has been decided to set up a committee to consider the present instructions for the examination of recruits as regards ear disabilities, and to submit recommendations for the guidance of administrative officers in dealing with the invaliding of soldiers with ear disease.

As regards the invaliding for tuberculosis, this is chiefly for pulmonary disease, 176 cases being invalided, compared with 31 for all other forms of tuberculosis.

The average number constantly in hospital was 24·91 per 1,000 of strength, compared with 27·42 per 1,000 in 1927 and 25·63 in 1926.

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The average number constantly in hospital from gonorrhœa was 806·94, from inflammation of areolar tissue 214·01, from fractures 202·83, from malaria 185·63, and from inflammation of tonsils 183·19.

The average sick time to each soldier was 9·12 days, and the duration of each case of sickness 21·39, compared with 10·01 and 21·4 in 1927, and 9·35 and 20·57 in 1926.

The combined ratio of constantly sick in hospital and under treatment as out-patients was 39·98 per 1,000 of strength.

As in former years, we find that at home it is sickness from the more common diseases which causes the greatest loss to the State. Local injuries which result from training and games are not likely to vary much, but we hoped that as a result of the attention which has been directed to them disease of the digestive system and tonsillitis would have shown a change for the better. The figures for the digestive system, 213 constantly sick, are slightly higher than last year, but those for tonsillitis are practically the same. The figures for venereal disease are lower, 235 constantly sick, instead of 275. The total working days lost, 379,934, are fewer than 1927, but the improvement is mainly due to the comparatively few cases of influenza in 1928, and to a reduction of some 14,000 days in the case of venereal diseases.

If we examine the principal causes of admission to hospital, we find in nearly all the commands tonsillitis takes the first place, no matter whether the soldiers are serving in Aldershot, Southern or Northern Commands, North of Ireland or Scotland.

The cause may be partly overcrowding and deficient ventilation in places of entertainment, such as cinemas, to which the soldier now resorts more commonly than he used to do. There was a very high incidence in the Eastern Command, 54 admissions per 1,000 of strength probably indicating the influence of a crowded environment, as the figures for the East Anglian, a rural area, are only 37·19, much the same as those for the whole Army.

The chief causes of sickness abroad (except India) are venereal disease, local injuries, and diseases of the digestive system; the figures for 1928 show an improvement over those for 1927. The total working days lost from these diseases and tonsillitis and sand-fly fever were 215,533, compared with 290,985 days in 1927.

The number of cases of diphtheria in home commands fell from 317 in 1927 to 144 in 1928; this reduction is mainly accounted for by the fewer cases that occurred in the Brigade of Guards, after the Depot was transferred from Caterham to Canterbury.

There was a small outbreak of diphtheria in a group of boys in the School of Electric Lighting at Gosport, and another at the Duke of York's School. All the boys were tested, and those found to be Schick-positive were immunized.

The incidence ratio for dysentery showed a slight increase in 1928, due to the number of cases in the China stations. Excluding India, with

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an incidence of 15·6 per 1,000, North China had the highest incidence. Bacteriological examinations show an increasing number of bacillary cases. Out of a total of 1,067 for the whole Army, 246 were amœbic, 358 bacillary, and 463 unclassified.

In Egypt, out of 62 cases, 39 were bacillary and 9 amœbic. Of the bacillary cases, 22 were due to Flexner bacilli, 12 to Shiga, 2 to Sonne, 2 to Schmitz, and 1 to Morgan's bacillus.

In India, out of 4,567 cases (British and Indian) of *acute* dysentery examined, Flexner bacilli were isolated from 842 cases, Shiga from 172 cases, Schmitz from 29, Sonne from 31, and *E. histolytica* from 255 cases. On the other hand, out of 5,796 relapsing cases examined, Flexner bacilli were only isolated from 66, Shiga from 12, Schmitz from 3, and Sonne from 1.

The results obtained from laboratories in all parts of India indicate that *B. dysenteriæ* infections are the main cause of dysentery. Where laboratories do not exist, a microscopical examination of the stools has proved of great assistance in making a diagnosis. In about fifty per cent of the cases examined a typical bacillary exudate has been found.

Amœbiasis is stated to be fairly prevalent amongst the natives associated with troops, but an amœbic infection appears to be conveyed to troops with greater difficulty than does a bacillary infection.

A trial of immunization against bacillary dysentery by the oral administration of bilivaccine was carried out among the troops in Quetta, Poona and Secunderabad. The results in Quetta appeared to be slightly favourable, but in Poona and Secunderabad the incidence of bacillary dysentery among the protected was greater than among the unprotected.

In the Army at home and abroad (except India) there were 23 cases of typhoid fever, 1 of paratyphoid A, and 8 of paratyphoid B; 10 cases were placed in the undifferentiated enteric group. There was an outbreak of 25 cases in the Aldershot Command.

In India there were 197 admissions under the heading of enteric fevers; of these there were 57 cases from which the *B. typhosus* was isolated, 15 cases of paratyphoid A, and 7 of B and 2 of C; 116, from which the specific bacilli were not isolated, remained in the enteric group. The troops were inoculated to the extent of 97·7 per cent. The ratio per 1,000 of cases in the protected group was 3·48, and in the unprotected 9·66.

Re-inoculation with one cubic centimetre of T.A.B. vaccine has not proved satisfactory, and orders have been given that re-inoculation must be carried out by two inoculations of ½ cubic centimetre and one cubic centimetre T.A.B. vaccine.

Large numbers of blood-cultures have been made from cases of pyrexia, in which no definite cause can be assigned for a pyrexia of over forty-eight hours' duration, and an increasing number of cases of five to ten days' pyrexia, especially among Indian troops, have proved to be mild cases of typhoid fever.

Fevers of short duration without very definite symptoms give rise to

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great confusion in diagnosis, and it is hoped that as a result of the clinical and bacteriological work which is now being undertaken these cases will eventually be arranged in definite groups. During the year five cases of infection with *B. fæcalis alkaligenes* were reported from various stations.

Bacilli of the *Salmonella* group have also been isolated from cases of mild pyrexia and it is possible that such infections are a cause of a certain proportion of these short fevers.

In India the use of the term pyrexia of uncertain origin is practically restricted to fevers suggestive of the enteric group, but the symptoms of which are not sufficiently typical to warrant the inclusion of the cases in that group. Medical opinion yearly grows more in favour of the existence of a definite but hitherto unrecognized fever of short duration, and it is highly desirable that research should be concentrated on this subject. At present diagnoses of dengue, sand-fly fever, influenza are made, which are almost certainly incorrect in some cases.

During 1928 a group of 254 cases, which in previous years would have been diagnosed as sand-fly fever, influenza or pyrexia of uncertain origin, were differentiated as intestinal toxæmias. They were cases of fever of short duration, occurring chiefly in the summer months, which recovered quickly under treatment with calomel and a milk diet. This differentiation may explain the decrease in the number of cases of P.U.O. in 1928.

Statistics regarding these short fevers cannot be regarded as satisfactory, and intensive research both at home and in India is clearly necessary.

There was a substantial reduction in the incidence of malaria in 1928, mainly due to a decrease of 2,581 cases in India. The ratio per 1,000 of admissions was 35·7, compared with 49·5 in 1927. There was an increased incidence in South China due to the training of the troops in the new territory, but in most of the commands where this disease is endemic the reduction was significant. It appears that the reduced incidence is mainly accounted for by the reduction in the number of relapses. It is estimated that fifty per cent of the total admissions in 1928 were due to relapses. In India the reduction of primary cases was only about 500, but there were 2,000 fewer relapses as compared with 1927. This is probably related to the research work being carried out at Kasauli and other places.

A combination of quinine and increasing doses of liq. arsenicalis has been found most popular and efficient in curing benign tertian. Out of 231 cases treated at Quetta, fifty-seven cases relapsed, but thirty-one of these were cured by a second course. At Kasauli treatment with quinine and plasmochin has given the best results; only 5·5 per cent relapsed. An increasing number of troops is being sent to the hills on the "cold storage" system, and mosquito-proofing of barracks is being extended. Anti-mosquito measures are carried out in every station and Paris green has found favour as a larvicide.

In the section devoted to diseases of the nervous system there is a table which shows a definite increase in the incidence of hysteria. In seeking

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for an explanation of this, 154 cases occurring during 1927-28 were analysed, and according to the clinical symptoms were arranged in four groups: (*a*) Fits and convulsions, 82 cases; (*b*) tremor and spasm, 10 cases; (*c*) disturbances of sensation and aphonia, 10 cases; (*d*) mental symptoms and amnesia, 43 cases. In most cases there was a pre-enlistment nervous instability of the nervous system, and 60 per cent of the cases occurred within the first two years of service. In all the groups 25 per cent were invalided, but in group (*d*) 90 per cent were considered unfit for further service.

At the instigation and under the control of the consulting physician, special investigations and observations are being carried out by the specialists in medicine, and information of great value is being slowly accumulated. Diseases of the digestive system are still receiving attention, and cases of ulcer of the stomach and duodenum appear to be increasing in number, though this may be due to better diagnoses. The majority of these cases, whether subjected to medical or surgical treatment, appear eventually to be unfit for service.

A high standard in surgery has been maintained and particular success has been obtained in the treatment of acute appendicitis; the mortality following 544 operations was only 0·73 per cent. As regards the use of anæsthetics, at Queen Alexandra Hospital, Millbank, intratracheal ether has been largely used; it is specially useful for throat operations. In the smaller hospitals the usual general anæsthetic is ether given by the open method or in Shipway's apparatus.

In the department of hygiene it is noted that the accommodation at Caterham, where diphtheria was endemic for a time, is being improved. At Catterick new barracks are being erected to accommodate units of the 5th Division and to replace old dilapidated huts.

Owing to the Thames overflowing the embankment, the hygiene museum and the research laboratory in the Royal Army Medical College were wrecked and nearly all the models were destroyed. With the help of the commands at home and abroad, considerable progress has been made in the formation of new exhibits.

We note that the Hygiene Advisory Committee have been examining plans for a new isolation hospital at Tidworth and also a new pattern of web equipment.

Observations carried out under the guidance of the Directorate of Pathology on the prophylactic use of anti-catarrhal vaccines in the Aldershot and Southern Commands have failed to demonstrate that any beneficial result has been obtained.

The vaccine department has supplied a large number of different vaccines for the Army and the Royal Air Force.

A research at the Royal Army Medical College has shown that the immunizing powers of a vaccine of *B. aertrycke* are not injured by heating to 100° C. A study has also been made of the various strains in the

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Brucella group, and a paper giving the results of the work has been published in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS.

In the laboratory at Cairo it has been noted that several organisms belonging to the Flexner group failed to agglutinate, even after subculture, with standard anti-sera, when Dreyer's technique with formalized broth cultures was employed. Eight such strains without formalin, in saline suspension, agglutinated in full titre, and in broth cultures to about half titre, indicating the importance of physical conditions when flocculation tests are performed.

It will be seen from the extracts which we have quoted that the Report for 1928 is full of interest and deserving of careful study by all serving officers.

Clinical and other Notes.

NOTE ON EXPERIMENTS TOWARDS THE PRODUCTION OF A CHEAP INSECTICIDE FOR ANTI-MOSQUITO WORK.

BY MAJOR R. A. MANSELL, M.B.E.,

Royal Army Medical Corps.

DURING the past four months (March to June, 1929) experiments have been carried out with the idea of producing an insecticidal solution suitable, as regards both its activity and its cost, for use on a large scale in barracks. A reasonably satisfactory formula has been arrived at so far as mosquitoes are concerned, but it is not claimed that finality has been achieved. Flies are not obtainable in sufficient quantities and of sufficient activity for experiment at this time of the year—at any rate latterly—owing to climatic conditions. It has been noticed that none of the solutions used are quite so effective against "sandflies" as against mosquitoes.

The formula is one per cent of medicinally pure carbon tetrachloride and two per cent of synthetic oil of wintergreen in second quality kerosene with the addition of a quarter of a pound of bazaar napthalene (ordinary naphthalene balls) to each gallon.

The cost of this solution in Peshawar at present is about Rs. 2·8 per gallon.

Various substances have been submitted to test in numerous combinations and strengths. Formalin was at one time thought to be promising. This was at a time when it was being used in large spraying machines with automatic continuous mixing apparatus. Disappointment at inconsistency

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of results led to the discovery of what should have been obvious—that formalin solution is not soluble in kerosene.

It was known that oil of wintergreen, or the synthetic methyl salicylate, is a constituent of many commercial insecticides. Captain K. M. Bharucha, I.M.S., in Lahore District last year (1928) suggested the use of naphthalene. Carbon tetrachloride has been known for some time as an active insecticide. Attention was finally concentrated on these substances.

Pure carbon tetrachloride has been used because it was felt that with the quantities which it is necessary to use in the proper spraying of a barracks untoward results might be caused in those working the sprays, and because the commercial, impure product was not obtainable.

These experiments have extended over a considerable time both because of the numbers of trials and because an attempt has been made to rule out as many as possible of the sources of error, of which new ones came to light with some frequency. The more important precautions which have been taken are :—

Freshly caught, fed but not lethargic, and active mosquitoes have been employed. Flies were used in March, but these experiments served only as a basis for the subsequent work.

The room used has been thoroughly aired between experiments and steps have been taken to ensure that only the insects (mosquitoes) belonging to the experiment were present at the time—(on only one occasion was a mosquito killed not of the species employed in the particular experiment and that was identified as belonging to the previous day's work).

Experiments were carried out in the early morning so that the mosquitoes should be "fresh" and so that those caught, if still alive, should not die from the effects of heat and low atmospheric humidity when kept in test tubes for observation (for this reason the period of after observation had to be limited to two hours).

The mosquitoes have been liberated and not kept in cages.

Spraying has been directed to the ceiling of the room and not at individual insects ; direct hits have not consciously been made.

The mosquitoes were picked up carefully with forceps and placed in test tubes lightly plugged with cotton wool so as to avoid mortal damage as far as possible.

The experiments have been carried out as follows—so far as they relate to the production of the present formula :—

Room: 6 feet × 6 feet × 9 feet = 324 cubic feet. Two windows, mosquito-proofed both outside and on an opening frame which was sealed with paper to allow the entry of a little light but no breeze. One small door, mosquito-proofed, facing away and protected from breezes.

Sprayer.—The small hand type now on the market.

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Solution.—Fifty cubic centimetres used for each experiment, of which an average of two cubic centimetres was not extractable by pumping. This took 150 blasts for its expulsion. It represents approximately five ounces of solution per 1,000 cubic feet.

Technique.—Mosquitoes were liberated at the end of the chamber distant from the door. Spraying was commenced into the ceiling at the door end of chamber and was worked systematically over the whole ceiling, along the walls and back till the supply was exhausted. Mosquitoes were collected from the floor. This was done with forceps, care being taken to do as little damage as possible. This first search occupied, on an average, five minutes. The windows were then opened and the search continued to include the floor, walls and ceiling. The opening of the windows usually allowed a slight breeze through the chamber. The search, on an average, lasted a quarter of an hour in all; when few mosquitoes were found it lasted longer.

Examination of Results.—Mosquitoes caught flying, or found to be capable of flying even for a few inches only on stimulation, are recorded as such. Mosquitoes recorded as "moving" were motile, at the second examination, only to the extent that close scrutiny with a lens revealed a moving limb or appendage; for practical purposes they were dead, in that none of those so shown finally recovered, though whether the atmospheric conditions did not play some part after the time of the second examination in loosening their weakened hold on life was not ascertained.

Average sample results of the experiments are appended to this note. The standard insecticides chosen are the proprietary products having the greatest local popularity.

Mixtures of first quality kerosene and ordinary commercial petrol in proportions of 3:1 and 2:1 do not leave any stain on fabrics with the chemicals under experiment in solution.

Second quality kerosene, if spilled on fabrics so as to leave a wet patch, leaves a slight stain which washes out; the quantity which falls in the ordinary spraying of a room does not leave any appreciable stain.

Third quality kerosene if spilled on fabrics leaves a stain which washes out with difficulty or not at all.

Admixture with petrol does not appear greatly to improve the insecticidal action of solutions in second quality kerosene against mosquitoes.

The formula here recommended is slightly irritating in the concentration used on account of the naphthalene, but evidence has been adduced that the napththalene, so used, is not only insecticidal to some extent, but also deterrent to further invasion by insects.

The use of insecticidal solutions in high pressure sprayers with extension tubings to deliver the spray into the roofs of barrack rooms has an obvious advantage over fumigation from the ground level, in that insects are subjected at once to its full lethal effects and are not able to escape upwards (as they naturally attempt) through imperfectly closing clerestory windows or holes in the roof; no sealing up of the room is necessary; removal of

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SAMPLE EXPERIMENTS FROM THE GROUP LEADING TO THE SUGGESTED FORMULA.

Kerosene			Petrol	Methyl salicyl.	CCl_4	Naph-thalene	Number of mosquitoes		Immediate results			After two hours		
1st	2nd	3rd					Released	Recovered	Flying	Moving	Dead	Flying	Moving	Dead
95	—	—	—	5	—	⅓	15	12	4	5	3	5	0	7
90	—	—	—	5	5	⅓	13	12	0	0	6	0	0	12
94	—	—	—	4	2	⅓	15	15	2	8	5	0	3	12
97	—	—	—	2	1	0	15	12	1	10	1	0	5	7
64	—	—	31	5	—	⅓	15	11	2	6	3	2	3	6
—	96	—	—	3	1	0	14	14	2	12	0	0	1	13
—	92½	—	—	5	2½	¼	15	14	0	13	1	0	1	13
—	97	—	—	2	1	⅓	15	16	0	13	3	0	1	15
—	97	—	—	2	1	⅖	15	13	0	12	1	0	6	7
—	97	—	—	2	1	½	15	15	0	15	0	0	2	13
—	—	95	—	5	—	⅓	15	14	4	5	5	0	0	8
Commercial preparations: Flit 1929 type							15	14	0	13	1	0	1	13
,, ,, Mosquil 1928 type							15	13	4	9	0	2	5	6

Quantities composing the solution are expressed in percentages except naphthalene, which is shown as pounds added per gallon.

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kit, equipment or furniture is not required; accidents leave no mess that cannot be removed by simple sweeping of the floor; the solution is cheap.

The specifications for kerosene in India are given in a note.

Specifications of Kerosene in India.

First Quality.—The oil shall be a petroleum or paraffin distillate, free from turbidity, acidity, water or impurity.

The oil shall comply with the following requirements: (1) closed flash point (Abel-Pensky) not less than 38° C.; (2) sulphur, not more than 0·06 per cent.

The colour shall be not deeper than that known as "prime white."

When 100 cubic centimetres of the oil are distilled in an Engler flask, the thermometer being immersed in the vapour, not less than 95 per cent shall distil at or below 300° C. The residue shall be entirely liquid, and shall not be charred.

The oil shall burn well in a Hinks single-wick lamp.

Second Quality.—The oil shall be a petroleum or paraffin distillate, free from turbidity, acidity, water or impurity.

The oil shall comply with the following requirements, but a Supply Officer may use his discretion in accepting an oil which does not comply with these but fulfils the remaining requirements: (1) closed flash point (Abel-Pensky) not less than 38° C.; (2) sulphur, not more than 0·10 per cent.

The colour shall be not deeper than that known as "standard white."

When 100 cubic centimetres of the oil are distilled in an Engler flask the thermometer being immersed in the vapour, not less than 60 per cent shall distil at or below 300° C. The residue shall be entirely liquid.

The oil shall burn well in a Hinks single-wick lamp and in pressure lamps, stoves, etc., without emitting a smoky flame.

Third Quality.—The oil shall be free from turbidity, acidity and impurities.

The oil shall comply with the following requirement: (1) closed flash point, not less than 100° F.

The colour shall be not deeper than that of a 2 per cent aqueous solution of potassium dichromate.

When 100 cubic centimetres of the oil are distilled in the Holde-Ubbelodhe apparatus not less than 60 per cent shall distil at 300° C.

———

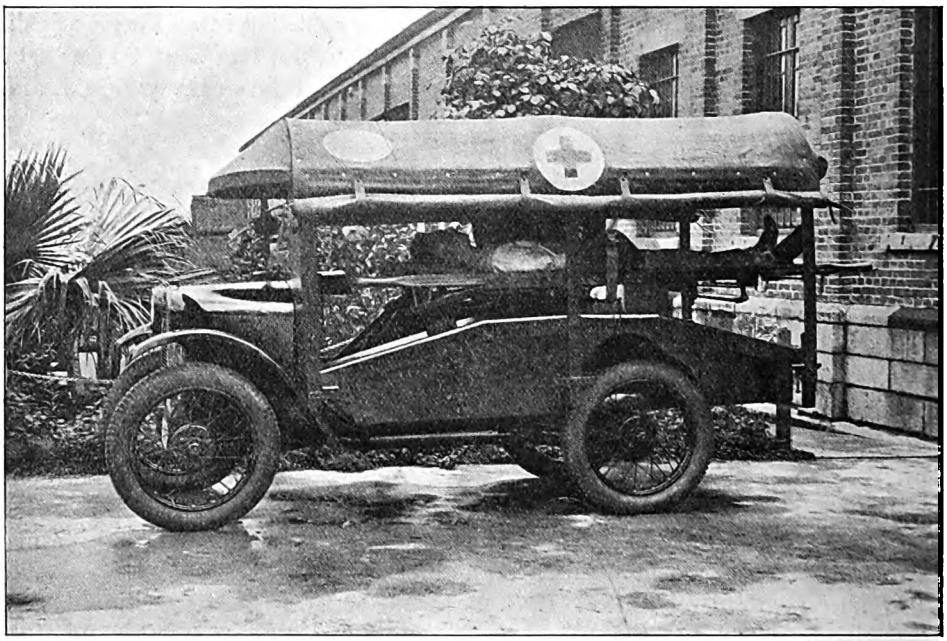
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AN AMBULANCE CAR FOR HONG KONG.

By Colonel J. S. BOSTOCK, C.B.E.

The accompanying photographs illustrate a small ambulance designed to meet the needs of the Military Hospital, Hong Kong, to which hitherto the carriage of sick has been limited to dhoolie, chairs, or wheeled stretcher.

On account of a large water conduit which runs beneath the narrow Bowen Road, heavy traffic is not permitted; but after some importunity



permission was obtained from the Civil Government to use a light ambulance. The War Office having approved the scheme and provided the chassis of an Austin Seven, Major W. White, R.A.O.C., undertook the work of designing and producing the body in the R.A.O.C. workshops.

A feature of the design is that the cradle which carries the stretcher is poised in the centre and so arranged that the patient—if properly balanced in the first instance—will maintain the horizontal position whilst the car climbs the steep hills.

The rail and stretcher can be removed in a moment to provide for sitting accommodation. On normal roads and gradients the capacity is one lying and one attendant, or two sitting and one attendant, in addition to the driver.

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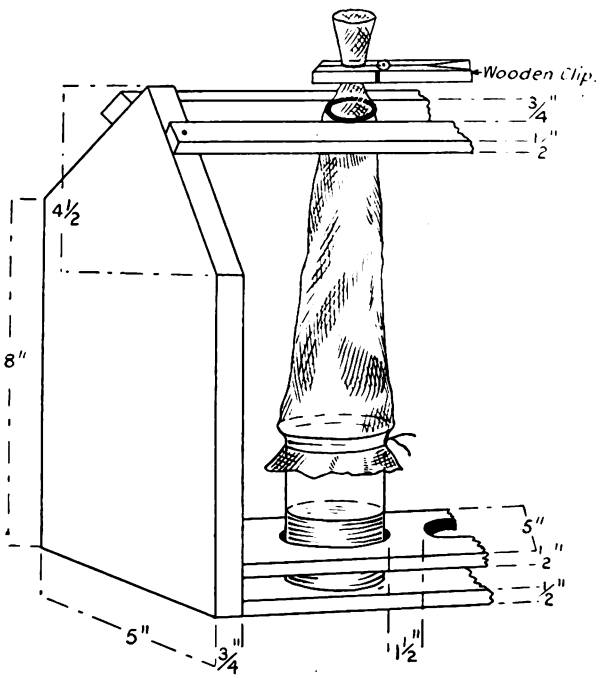
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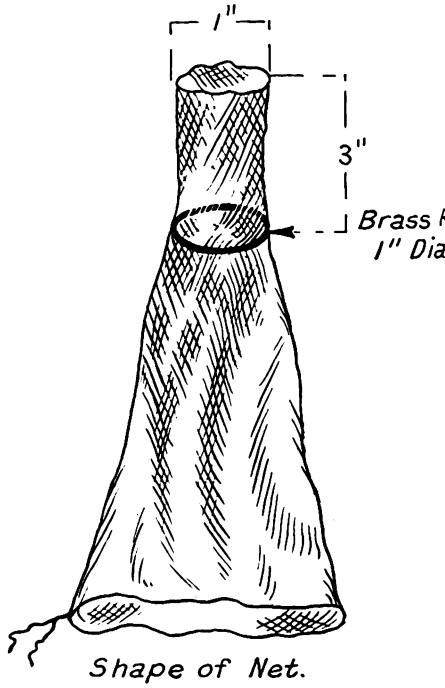
AN APPARATUS FOR BREEDING OUT THE LARVÆ OF MOSQUITOES.

By Major E. B. LATHBURY, O.B.E.,
Royal Army Medical Corps.

I enclose a rough drawing of an apparatus I have devised for breeding out the larvæ of mosquitoes from various places in connection with anti-malarial schemes. Possibly others may like to try it or to improve on it. I found the usual methods I have seen entailed a good deal of waste of time in catching the mosquitoes, which were also very liable to escape.

The exact measurements indicated are of course not very important,





Shape of Net.

but will be found satisfactory. The racks are made for twelve ordinary 1-lb. jam or marmalade jars which are easily obtainable for nothing, and uniform in size.

The brass ring sewn on to the top of the conical part of the net rests on the horizontal bars, and an ordinary wooden domestic clothes clip closes the top. When it is desired to extract the insects, a test tube about 1 in. diameter is passed down as far as the ring, after having taken off the clip, when the mosquito readily flies up into the tube and the clip is then replaced.

The cost of the wooden frame should not exceed 3s.

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Echoes of the Past.

THE MEDICAL DEPARTMENT OF WELLINGTON'S ARMY, 1809-1814.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps.

(*Continued from p.* 72.)

The Portuguese Medical Service.

Of the Portuguese Medical Service something can be learnt from the correspondence of Inspector William Fergusson, preserved in the College Library. At the outbreak of war the status of the surgeon in that country was an extremely humble one. The regimental medical officers were in actual fact the barbers of their corps. The General Hospitals were the ordinary civil ones, staffed by civilian physicians. The senior physician, the Physico Mor, also a civilian, controlled the disposal of sick from the army. He alone had access to the Portuguese Government, and could offer advice on matters of hygiene. Fergusson, who became the head of the British Mission in the autumn of 1809, with the rank of Surgeon-General in the Portuguese army, was subordinate to the Physician-General, who controlled the fixed hospitals; and the position of the twelve British surgeons, later increased to twenty, who were sent with him to establish some sort of organization, was a difficult and thankless one. The General Hospitals, administered under the direction of the Portuguese Physician General from his office in Lisbon, were filthy, ill-found, and ill-served, being in fact, as Fergusson officially described them, the army's most destructive and dangerous nuisance. In the field alone the surgeons were allowed something like a free hand. One was sent to each brigade, and wherever possible a Brigade Hospital was formed on the British plan staffed by the Brigade Surgeon and the regimental medical officers. These proved very successful.

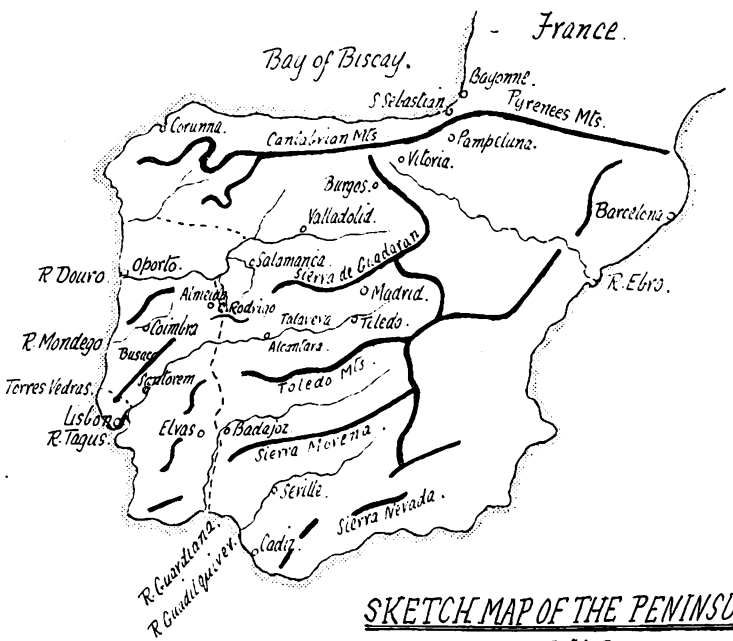
Among the British officers in the Portuguese service who did specially valuable work were Andrew Halliday and Augustus West. Both rose subsequently to some distinction and were knighted by George IV. William Fergusson held the post of Surgeon-General in the Portuguese army until the end of 1812, when he was succeeded by Francis Burrows.

The Campaign of the Douro, 1809.

After Sir Arthur Wellesley assumed command at Lisbon in April, 1809, the British troops in Portugal numbered about 28,000. At the same time the process of the reorganization of the Portuguese army under Sir William

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Beresford had been commenced. The French armies in Spain contained between 200,000 and 300,000 men, of which part, under Soult, were in occupation of Oporto, and another force under Victor was within fifty miles of the eastern frontier. These two were out of touch with each other, and, taking advantage of the situation, Wellesley advanced northwards, defeated Soult on the Douro and drove him over the frontier. Then, retracing his steps, he prepared to engage Victor. The British army was deficient both in its medical personnel and in medical material. The regiments had mostly a surgeon and two assistant surgeons, a cart to carry the arms of men falling sick on the march and some medical comforts, and a mule to



SKETCH MAP OF THE PENINSULAR WAR.

carry the surgical panniers. They also had with them twelve sets of hospital bedding. There was a staff surgeon to each brigade, but no provision seems to have been made for junior staff officers to work any General Hospitals which might have to be formed. The orders issued show not only how the regimental medical establishments had to be depleted to provide doctors for the sick left behind, but also the demands on the fighting strength of the force for hospital commandants, wardmasters, stewards, and sick attendants.

"*Coimbra, May* 6.—The regimental surgeons of the brigades about to march will immediately report the number of sick they intend to leave behind to Staff Surgeon Morrell charged with the duty of superintending them. An assistant surgeon from each regiment will remain with the

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sick till they are properly given over; and one or more assistant surgeons per brigade according to numbers will remain at Coimbra to take care of them."

The Battle of the Douro was fought on May 12. Our casualties in the engagement were small, but there was already a heavy sick list on account of dysentery. During the pursuit of the French the following order was issued:—

"*S. Pedro, May* 19.—The different brigades will leave at Braga such men as are unable to march, in charge of an assistant surgeon from each brigade, till a hospital can be established there. Officers must be left in Braga in charge of the sick of each brigade in the proportion of one subaltern to 30 men, one captain and one subaltern to 100. A sergeant must be in charge if the number left is under 30, and a sergeant and corporal, besides the officer for each 30 above that number."

A General Hospital was formed at Oporto on May 24, when officers, N.C.O.'s and hospital orderlies were ordered to be supplied on the same scale.

The Head of the Medical Department in the field was Deputy-Inspector William Fergusson, who had previous war service in Flanders and the West Indies. His writings show him to have been a student of the subject of medical administration as well as medicine, and he had very definite ideas on both. Like others who had had personal experience of the mismanagement of the General Hospitals in Flanders, he was a strong advocate of the Regimental system. On his appointment the following November as Inspector of the Portuguese army hospitals, he wrote to Sir William Beresford: "The Regimental Hospital is the cardinal hinge on which the health of the Army depends, the first resource of the sick soldier and best security for maintaining the health of the force. In actual war, and during rapid movements of troops, the sick must be left behind, and then General Hospitals are necessary, but these ought not to be regarded as permanent, but only temporary expedients to meet the pressure of service and in no respect essential under ordinary conditions to the proper care of the soldier. The plan of the General Hospital should be precisely that of the Regimental Hospital on a more extensive scale. It is impossible that these can be well conducted unless by medical officers of good education who have acquired experience of medical practice and a knowledge of the soldier, his diseases, temper and habits in Regimental Hospitals. . . . Even under the circumstances mentioned, General Hospitals will always prove a great though a necessary evil, destructive of the effective strength of armies. For diseases are difficultly cured wherever a large body of such are aggregated together; new contagions are certainly generated, and discipline is imperfectly preserved because the dread of immediate punishment is removed. In all armies the sick should never under any circumstances be sent to the General Hospitals while their regiments are present on the spot."

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Fergusson's remarks about General Hospitals were true enough, but the possibility that by suitable measures effectively carried out the evils might be greatly mitigated seems hardly to have been realized until McGrigor took them in hand in the third year of the war.

The Talavera Campaign.

The Army arrived at Abrantes on June 7 and remained there till the end of the month. There was insufficient transport, the troops were without pay, the military chest was empty, and the hospitals full. There were 4,000 sick, some at Oporto, some at Coimbra. The hospital bedding belonging to regiments had all been called in to provide for the General Hospitals, but the surgeons were allowed to keep their carts. The employment of the local bullock wagons for the transport of baggage was forbidden, as they would delay the march. Except for the ammunition train carts there was no other wheeled transport. Infantry battalions were allowed fourteen mules each, including the surgeon's, the paymaster's, and one to carry the camp kettles. Relying on the promises of the Spanish Government, Wellesley anticipated that both supplies and transport would be found when he crossed the frontier. The promises were never carried out, a fact which caused the utmost embarrassment throughout the operations and materially affected the efficiency of the arrangements for the sick and wounded.

Complaints were already beginning to come in of the misconduct of the convalescents in the General Hospitals, especially at Oporto. Orders issued on June 17 referred to the preservation of discipline and directed that those who were fit were to be sent back to the Army in batches of forty under the command of an officer. On June 21 the following G.O. appeared, "Surgeons of regiments may send their patients who are not likely to do well in cantonments to the General Hospital now ready at the Convent of S. Antonio, but each man is to be previously inspected and approved by the Staff Surgeon of his Division." This is the first mention of Divisional P.M.O.'s. The organization of the force up to this time seems to have been on a brigade basis. One June 25, the Deputy Inspector of Hospitals was directed to arrange for all men likely to be sick for any length of time to be sent to the Convent Hospital, which was to be staffed by regimental surgeons, found from brigades. The last order issued before the march was as follows:—

"*Abrantes, June* 26.—Officers and N.C.O.'s are to be detailed by brigades for the charge of the sick at Abrantes, as by G.O. dated May 19 Company officers are to leave subsistence money with the surgeon up to the 24th. In future General Officers commanding Divisions and Brigades will direct that men falling sick on the march will be carried on till orders are given for forming a General or Brigade Hospital. . . . The huts at present occupied by General Tilson's Brigade are to be used for the sick left in Brigade Hospital. Staff-Surgeons of Divisions will distribute the

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huts to the different brigades, and order enough surgeons from each to remain with the sick. Regimental surgeons are to draw a blanket from the purveyor's stores for each man left in the huts."

On the following day the Army entered Spain, 21,000 men and thirty guns. On July 15, Headquarters were at Plascentia, where Wellesley was in touch with the Spanish army, 38,000 strong, under General Cuesta. At this place a General Hospital was established. On the same day a report of the D. I. Hospitals was published in General Orders with appropriate comments by the Commander of the Forces. "Men have lately been sent to hospital, both here and elsewhere, in a state of the utmost filth; some with no shirts at all and others with only one, which had not been washed for a very considerable time: greater attention to cleanliness and the men's necessaries seems therefore called for in some brigades; and bathing, whenever possible, at an early hour of the morning, and at no other time, ought to be universally practised during the hot season. The present species of contagious fever is infallibly generated among the troops by the neglect of personal cleanliness. New killed meat without salt is very prejudicial; and the mode of issuing and conducting the rations has been productive of much annoyance, exhaustion and disappointment, and consequently of disease to the soldiers." A G.O. issued about this date orders breakfast to be provided for the men whenever practicable. This was a somewhat recent innovation. An order published at home the previous year is mentioned in Gardyne's "Life of a Regiment" (The Gordons). A recipe was given for a pottage made of milk or small beer with oatmeal, salt or molasses, which was much recommended. The cost was a little over a penny a head.

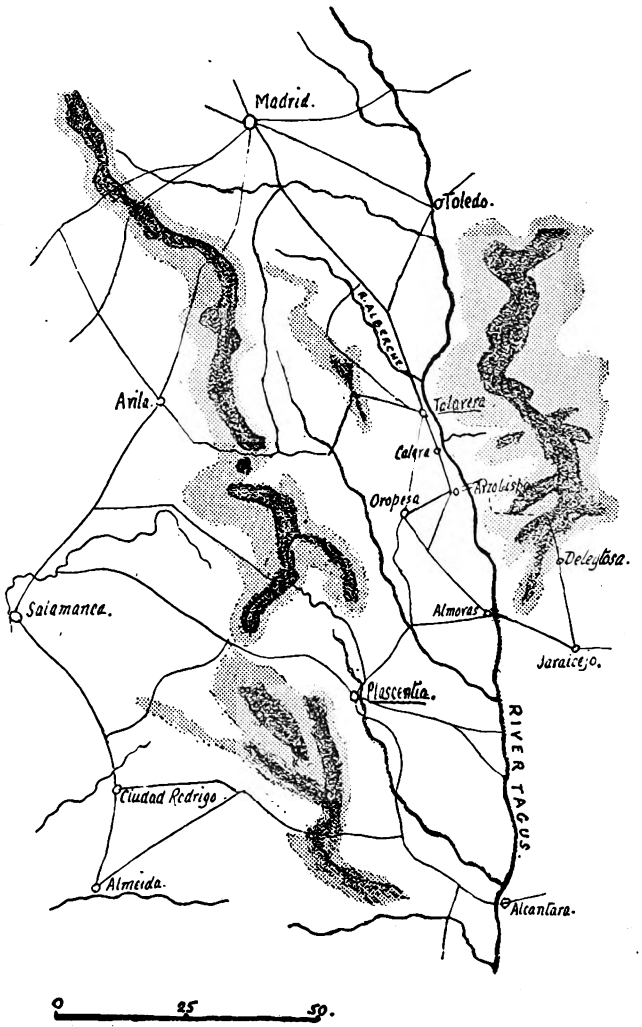
Leaving Plascentia on July 17, Oropesa was reached on the 20th after hot and tiring marches, in the course of which there were many stragglers. No transport had been received and the men were on reduced rations.

The British force was now committed to a campaign in the narrow entangled valley of the Tagus, barred at one end by Victor's force based on Madrid, while an army of equal strength under Soult was massing on its flank and rear. Effective co-operation with Cuesta proved impossible owing to his pride and obstinacy, and the Spanish army was a danger rather than a help. On the 28th, however, the two Generals offered battle to Victor. The Spanish right rested on the river at Talavera, while the British extended the line along a low range of hills to the foot of the mountains, a front of about two and a half miles. Victor attacked the key of the position during the evening and was repulsed. Fresh attacks on the following morning were driven off after severe fighting. The Spanish were hardly engaged. General Crauford's Light Brigade, consisting of the 43rd, 52nd and 95th, arrived just too late to participate in the fighting. It had reached Oropesa after a twenty-four mile march on the forenoon of the 28th, but hearing that a battle was in progress immediately started again, and reached Talavera before noon on the 29th. The men carried between fifty

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and sixty pounds weight, they were short of food and water, and the heat was excessive. Nevertheless all but seventeen came in, having covered over fifty miles in twenty-six hours.

The Principal Medical Officer was confined to his billet with dysentery



The Talavera campaign.

during the battle, but George Guthrie, who was one of the senior regimental surgeons present, acted as his deputy in the field. The plans of the battle show the park and hospitals sited behind the hill on the left of our position where the hardest fighting took place, and this was probably the position of the majority of the dressing stations. It was about 700 yards behind the most advanced troops. The last shots were fired about 6 o'clock,

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and a little later the grass caught fire, the flames spreading over a large area where the dead and disabled lay. Those on the outskirts who could move managed to crawl away, but many perished in the flames.

Early on the morning of the 29th Victor's army retired across the Alberche to the Salinas heights, and the next forty-eight hours were spent in bringing in the wounded and trying to collect food. Though well supplied with transport and provisions, the Spanish, who had themselves few casualties, refused either to help in clearing the field or to share a part of their rations with our starving men. Soldiers and civilians alike amused themselves in beating out the brains of the French wounded until the British opened fire on them. As the casualties were collected, they were removed to General Hospitals, which had been prepared by the Purveyor's staff in Talavera. Schaumann, the Commissary, describes how, in passing the great convent, to which most of them were taken, he saw both dead and wounded dumped round the entrance. From the front windows issued the cries of those whose limbs were being amputated and, from time to time, arms and legs were flung out into the small square below.[1]

The following G.O. was issued on July 30 : "The Commissary-General will attend to the requisitions of the Inspector of Hospitals for provisions and other articles for the sick and wounded in General Hospital. The brigades are to appoint officers and N.C.O.'s to take charge of the sick and wounded in proportion to their numbers according to the General Order. These are to be selected from those who have slight wounds which are likely to detain them in Talavera, at the same time that they are not likely to be confined to their houses for any length of time. A Field Officer from the 1st Division is to be appointed to superintend the military arrangements of the General Hospital."

The British losses in killed, wounded and missing amounted to 6,200. The wounded accounted for were 3,915. On July 30 a corps of Soult's army occupied Plascentia, which was full of convalescents and non-combatants of various kinds. About 2,000 got away, among those captured being 400 sick in hospital.

On August 3 Wellesley, with 17,000 men, marched to Oropesa with the object of engaging Soult, Cuesta with the Spanish remaining at Talavera. The British hospitals were placed under the latter's protection, an agreement being made that in case his army should move transport would be provided to clear the patients. When, on the following day, Victor's army showed signs of renewing the attack, Cuesta handed over seven bullock wagons to the British Commandant in the town and bolted after Wellesley. Stores and baggage were sacrificed, and a convoy made up. Men able to crawl followed as best they could, while 1,500 were left behind. This convoy arrived at Calera in a most wretched condition, when Wellesley, having discovered the true strength of the enemy opposed to him, had

[1] "On the Road with Wellington."

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already made his dispositions for a retirement across the Tagus. Though it endangered the safety of the force, the movement was delayed six hours to cover the passage of the wounded over the Bridge of Arzobispo. From here the convoy proceeded to Deleytoza, where all casualties were collected in a great convent. Here also Headquarters arrived on the 7th. George Guthrie described the hospital as a slaughter house where many lives were sacrificed by unnecessary amputations. The next move to Merida was only accomplished by unloading the treasure and several ammunition carts. The army remained round Deleytoza and Jaraicejo till August 20, when it was withdrawn by way of Truxillo and Merida to cantonments round Badajoz. To provide sick transport for the final stage, the ammunition park and the remaining stores were dumped, when the Spanish produced plenty of carts and carried the latter away for their own use.

Meanwhile the French had occupied Talavera on August 6. Here the British and French wounded had been left under the care of Staff-Surgeon Summers Higgins, with whom were Staff-Surgeon McDougal and Assistant-Surgeons Elkington (24th), Mahoney (7th), Rule (87th), and Heriot (61st).[1] The greatest consideration was shown them. The inhabitants, who had concealed large quantities of provisions and refused to supply their allies, were soon made to disgorge, and, though the French troops were hungry, precedence was given to the wounded prisoners. Marshal Mortier, on visiting the hospitals, congratulated Higgins on their condition, and said he wished his own were as good. The captured surgeons, together with Assistant-Surgeon Curby of the 29th, taken at Plascentia, eventually found their way to Verdun, where they were well treated and released in June of the following year.[2]

Sir John Fortescue comments on the risks taken, and the stores and ammunition sacrificed to bring away the wounded in the face of a civilized enemy. As it was, there appears to have been some criticism made at home on the numbers left behind, though many of these must have been quite unfit to be moved.

The Guadiana valley was malarious, and a form of low fever was prevalent. There were 500 deaths during the autumn. Large local purchases of hospital clothing and bedding, and even medicines, had to be

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[1] A memorial of this event is the Talavera cup, now in the R.A.M.C. Central Mess, the inscription on which states that it was presented by the wounded British officers to S.S. Higgins in recognition of "the unshaken Constancy with which he offered up Liberty and Expectations at the Shrine of Humanity aud Public Duty." There is a painting of this officer in the Mess.

[2] The status of captured medical officers was not as yet clearly defined. Wellington later proposed that they should be returned by either side without exchange, but the matter was never settled. When Hospital Mate McCulloch, captured at Salamanca in 1812, was repatriated eight months later, a French doctor was released in return.

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made. General Hospitals were established at Elvas, Estremoz, and Villa Vicosa, but these did not obviate the necessity of the retention of numbers of men in the Regimental Hospitals of the troops cantonned in Badajoz, Talavera, Real, Lobon and Montijo. On September 3 the General Hospital at Abrantes was closed, and the sick unfit to rejoin were taken down the Tagus by boat to Lisbon. The shortage of medical personnel was acute. On November 19 Wellington wrote home: "Some effectual means should be taken to increase the medical staff, not with gentlemen of rank, but with hospital mates. The duty of the General Hospitals in every active army ought to be done by the general medical staff, and the regiments ought to have their surgeons and assistants entirely disengaged for any extraordinary event or sickness that may occur. We have now not one surgeon or assistant with each regiment instead of three, the others being employed with General Hospitals instead of hospital mates, and we have always been equally deficient."

The morning state of the Army in Portugal on November 1 showed 22,622 effectives, sick present 3,173 and sick absent (i.e., in General Hospitals) 5,843. Of these 1,500 were wounded. On the 20th orders were issued to clear the sick remaining in regimental hands into General Hospital.

On November 23 Dr. Fergusson was appointed to the Portuguese army with the local rank of Inspector of Hospitals, by which time a senior officer, Inspector James Franck, had arrived as Head of the British Medical Department. Franck had been Physician to the Forces under Sir Charles Stewart in Corsica, and had served in the Egyptian War of 1800. He was evidently an estimable person, and Wellington more than once expressed his entire confidence in his abilities, but he possessed neither the initiative, the organizing capacity, nor the personality of his great successor.

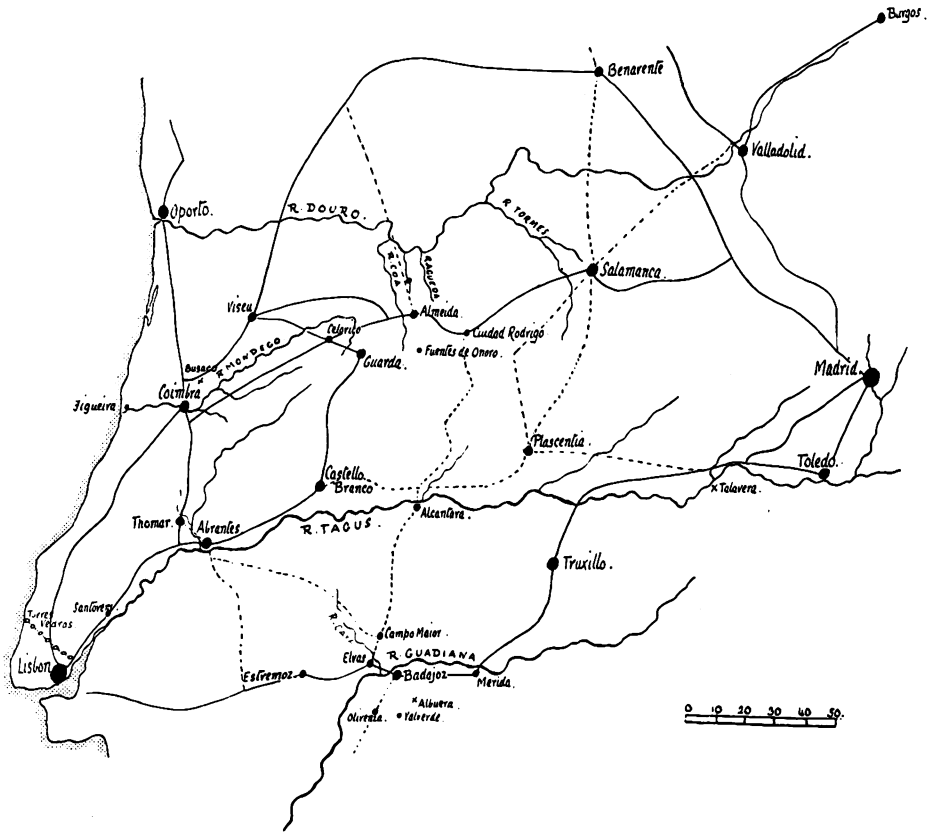
1810.

In January the troops moved to the line of the Mondego river with outposts on the Coa and the Agueda. The fortresses of Ciudad Rodrigo and Almeida were held by Spanish garrisons. A hospital centre for the British was established at Coimbra to which weekly convoys of sick were despatched from Vizeu and Celorico. Here all but the most protracted cases were retained. The remainder were sent down the river to Figueras, where there was a small hospital, and embarked for Lisbon, which had now a large group of hospitals and a Convalescent Depot.

In June Massena commenced his invasion of Portugal by investing Ciudad Rodrigo and Almeida. The first fell in July. On July 23 Craufurd, who was watching the enemy's movements round Almeida, fought the action of the Coa before withdrawing his force. As the whole Army was now on the point of retirement, orders were issued to clear the wounded to the rear as rapidly as possible. The casualties of the Light Division

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were therefore collected at Pinhel, sent down the river in boats and embarked for Lisbon. On September 10 the hospitals at Coimbra were closed. On September 27 Wellington, who had been retiring down the Mondega, turned to fight at Busaco. The French were beaten off with a loss of 6,000, the casualties of the British and Portuguese amounting to 1,200, less than three per cent. The French wounded covered the slopes of the hills where the British held a strong position, and every facility was allowed for their removal, our own men even lending a hand. Amenities



of this kind were a common feature of the war. After the occupation of Oporto a safe conduct was allowed the French surgeons to pass in and out of the town and, on several occasions, the French wounded owed their escape from death at the hands of the Spanish to British efforts. The generosity of their opponents was reciprocated by the French, notably at Talavera.

Coimbra was evacuated on September 30, and by October 10 Wellington's army was behind the carefully-prepared lines of Torres Vedras. Massena had occupied the great convent at Coimbra vacated by us for the accommodation of his own sick. On October 6, General Trant, in command of a

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small independent force, raided the town, and carried off 4,000 of them prisoners to Oporto.

The following G.O. was issued on October 5 at Alcobaca: "As the divisions of infantry will pass through Rio Mayor, three spring wagons will be attached to each to be under the direction of the Staff Surgeon. Nothing is to be put in them but sick soldiers or their packs and arms. Medical panniers or other stores are positively not to be carried in them." Henceforth the spring wagons of the train seem to have been used almost exclusively for this purpose.

The sick and wounded in the retreat had a miserable time. Transport was collected with difficulty, consisting mainly of mules and the rough ox wagons of the country. The soldiers told off as attendants on them got drunk and went off in search of plunder and they got little to eat. The sight of their pallid faces and their piercing groans as the wagons bumped over the rough roads haunted Sergeant Donaldson for long after.[1] For this Wellington stated he held the Officers of the Medical Department in no way responsible, declaring that their duty on this painful occasion was done in the most meritorious manner.

All preparations were made to embark the Army should it be necessary, and the worst cases at Lisbon were ordered to be sent on board ship. Every man was needed to hold the position. An order issued on October 23 commented on the fact that the number of men shown as sick in regimental returns was more than double those on the hospital books at Lisbon. Soldiers supposed to be sick had been seen walking about the town perfectly well. Order must be enforced there. "Medical Officers are on no account to be allowed soldiers as batmen. A board is to be assembled under Colonel Peacocke with a view to cutting down the number of soldiers employed as clerks, storekeepers, wardmasters and orderlies and to advert to the necessity of Officers of the Medical Department attending themselves to the wards, and not employing N.C.O.'s as wardmasters at a time when the whole Army are left at their posts day and night. The Commander of the Forces must insist on Officers of the Medical Department being at all times in the wards of the hospitals. Soldiers sent to the Convalescent Barracks at Belem are not sent for their amusement, but for the benefit of their health. There is no occasion for them to be in the streets and public houses at all hours of the day and night. They are not to leave the barrack yard except under an officer or N.C.O." There were at this time thirteen General Hospitals, but in November they were cut down to four. Convalescents were also sent to ships anchored in the harbour. The P.M.O. Lisbon was Deputy Inspector Abraham Bolton.

1811.

Massena found the position too formidable to attack and, having lost 6,000 men, mainly from starvation, retired on November 15 to Santarem.

[1] "Recollections of the Adventurous Life of a Soldier."

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In March, 1811, he commenced his disastrous retreat followed up by Wellington, who had now received reinforcements.

On November 16 the Adjutant-General wrote to Dr. Franck: "I am directed to acquaint you that in the advance of the Army it will be necessary to provide for the establishment of General Hospitals at different stations which will be fixed according to circumstances. They will be in the first instance on the Tagus. It is desirable therefore that you should immediately make arrangements for sending up the river bedding and other articles and medical attendants, in the first instance for a hospital of 300 men at Villa Nova, and nextly for 300 more at Santarem. The men would be sent down from these establishments to Lisbon, and, in proportion as the Army should advance, they would be broken up and others formed in more advanced situations. From what I have stated, you will see that your presence at Headquarters will now become essentially necessary."

In following up Massena the Army had some hard fighting to do. He was finally driven out of Portugal on April 5. The following medical orders were issued in March and April.

Santarem, March 6: "A sick depot to be established at Santarem in charge of an Assistant Surgeon-General of a division."

Redinha, March 12: "Wounded of divisions to be sent to Pombal on commissariat mules."

Aguia, March 14: "Each division and cavalry brigade to send out a subaltern, sergeant and thirty men to collect wounded and bring them to the Condeixa road." (Battle of Casal Nova.)

Heights of Miranda de Corvo, March 15: "Sick and wounded to be sent to Coimbra."

Lousao, March 17: A hospital establishment is ordered at Coimbra. The 5th Division to send a captain as commandant."

Celorico, April 1: "A hospital establishment ordered at Celorico. The 6th Division to send a captain as commandant."

Arrangements were now made to send transports from time to time to Figueras, at the mouth of the Mondego, to evacuate sick to Lisbon.

Wellington now directed Beresford to commence the siege of Badajoz, reinforcing his army for that purpose, and sending up the material for two General Hospitals. Each of these was calculated for 300 men, and one of them was capable of expansion to 800. This provision was made on the understanding that very slight cases were to be treated with their regiments, and that those likely to be protracted were to be evacuated to Lisbon. Beresford's force consisted of the 2nd and 4th Divisions and Portuguese troops, about 17,000 men. Meanwhile, Wellington blockaded Almeida. On May 5 he encountered the army of Massena, which was advancing to relieve the town, at Fuentes de Onoro. An obstinate and indecisive battle ended in the withdrawal of the French, our loss in a force of 25,000 British and 12,000 Portuguese amounting to 1,530 killed and wounded. The battle had raged through the town, which we held at the end of the fight, but

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the wounded were assembled at Villa Formoso, some twelve miles distant, where all the houses were taken up. Here there was great overcrowding, and gas-gangrene, which had supervened in several of the wounds, spread to other cases. Grattan, a subaltern of the Connaught Rangers, who came to look up one of his wounded friends, found him with a bullet wound clean through his chest. He ascribes his eventual recovery to the great skill and attention of the surgeons, who treated him by vigorous bleeding, as much as three to four times a day. On his return he passed what he calls the amputating hospital, which was in the courtyard of a nobleman's house. "I looked through the grating and saw about 200 wounded soldiers waiting to have their limbs amputated, while others were arriving every moment. It would be difficult to convey an idea of the frightful appearance of these men; they had been wounded on the 5th and this was the 7th; their limbs were swollen to an enormous size, and the smell from the gunshot wounds was dreadful. Some were sitting upright against a wall, under the shade of a number of chestnut trees and, as many of them were wounded in the head as well as in limbs, the ghastly countenances of those poor fellows presented a dismal sight. The streams of gore which had trickled down their cheeks was quite hardened with the sun, and gave their faces a glazed and copper-coloured hue; their eyes were sunk and fixed, they resembled more a group of bronze figures than anything human. There they sat, silent and statue-like, waiting for their turn to be carried to the amputating tables. A little farther on, in an inner court, were the surgeons. They were stripped to their shirts and bloody; a number of doors, placed on barrels, served as temporary tables; to the right and left were arms and legs, flung here and there without distinction, and the ground was dyed with blood.

"Dr. Bell[1] was going to take off the thigh of a soldier of the 50th, and he requested I would hold down the man for him. He was one of the best-hearted men I ever met with, but such is the force of habit, he seemed insensible to the scene that was passing around him and, with much composure, was eating almonds out of his waistcoat pocket, which he offered to share with me. The operation was the most shocking sight I ever witnessed; it lasted half an hour, but the man's life was saved. Near the gate, an Assistant Surgeon was taking off the leg of an old German sergeant of the 60th. The doctor was evidently a young practitioner, and our Staff Surgeon took much trouble in instructing him."[2] The narrator noticed that the first cut seemed to be far the most painful, after which the operation was borne with comparative indifference, or even boredom. When the arteries were being taken up, all the men said it felt like the application of a red-hot iron.

Beresford opened his trenches before Badajoz on April 21. On him descended Soult's army, compelling him to break off the siege and retire

[1] Arthur Bell, Staff Surgeon, 3rd Division, died at Abrantes the following year.

[2] W. Grattan. "Adventures in the Connaught Rangers."

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across the Guadiana, where he joined up with a force of 15,000 Spanish, under command of Blake. On May 15 he offered battle at Albuera. He was out-generalled, but the situation was saved by the desperate valour of the British regiments, who lost half their strength. Fighting lasted from 9 a.m. to 3 p.m.

George Guthrie was present as a divisional surgeon, and was the only medical staff officer on the field. He quickly sized up the situation, and gave some very shrewd advice to the regimental surgeons on avoiding premature opening of their dressing stations. He was under fire all day, and his assistant surgeon was killed by his side.

When the pickets had been posted in the evening there was hardly a man left to remove the wounded, and the Spanish would lend no assistance. The transport available was four wagons, and the surgical equipment the regimental panniers. The wounded lay during the night amidst the piles of corpses, while storms of rain swept over them. Eventually, 3,000 of them were collected in the village of Valverde, where for three weeks Guthrie and the regimental surgeons worked eighteen hours a day.

One of the General Hospitals was now at Elvas, where was Deputy Inspector William Hogg. He seems to have been unable to offer much assistance. The other hospital was at Estremoz. Wellington wrote from Elvas to Dr. Franck, on May 20: "My dear Sir,—You will have heard that Sir William Beresford fought a severe action on the 16th. The result is a great number of wounded in hospital, in addition to a considerable number already here. The gentleman here appears to me to be doing everything that is in his power, and has written to Lisbon for further assistance. I have written also to General Peacocke,[1] and have desired that all possible assistance may be sent here, and 2,000 sets of bedding. It is impossible to calculate the number of wounded there will be, but I should think at least that number. You will know best whether from the state of the hospitals elsewhere it will be possible to send assistance from other quarters. P.S.—I have desired Mr. Hogg to take care not to allow his hospitals to become too crowded, and to evacuate upon Estremoz in time."

Meantime fighting had occurred in the south of the Peninsula. Early in 1810 a large part of the French forces had been detached for the invasion of Andalusia, which fell an easy prey. In February Victor commenced the blockade of Cadiz, which held a considerable Spanish garrison and a small British force under Sir Thomas Graham. The Head of the Medical Department at this place was Sir James Fellowes, a physician who had some considerable reputation as a specialist in tropical medicine and had been knighted for his investigations in S. Domingo. An outbreak of yellow fever occurred at Cadiz soon after his arrival in which he showed courage and resource, and the epidemic did not extend to the troops, though

[1] Commandant at Lisbon.

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during a second outbreak in 1813 they were not so fortunate. In March, 1811, Graham, having taken troops round to Algeciras, by sea in co-operation with a Spanish force, struck at Victor's flank. The victory of Barossa on May 6 was a most gallant achievement though barren of results, owing to the refusal of the Spaniards to follow up the enemy. Our casualties were 25 per cent. No transport was available on the field, where the wounded of both armies lay until the following day. The blockade was raised in August, 1812.

The siege of Badajoz was resumed but, after two unsuccessful assaults had been delivered, was discontinued on the approach of Soult. On June 16 an order was issued that all men unable to march were to be sent into General Hospital. Elvas was left with a garrison, and from June 17 to July 18 the troops occupied the mosquito-infected valley of the Caia. The arrival at the time of reinforcements recently from Walcheren, their blood loaded with malarial parasites, could hardly have occurred at a more unfortunate moment. There were numerous cases of ague. A G.O. of June 23 dated at Quinta dos Banos ordered the establishment of a General Hospital at Alter de Chaõ, eight leagues from the advanced post of the Army. "Sick to be sent there on return mules or by such conveyance as Commissaries can procure." We know from the account given by one of the Assistant Surgeons that a third of the fever patients had to be tied on the mules' backs. He observed that many of them improved wonderfully on the journey.[1] On August 1 Ciudad Rodrigo was invested. At the end of September the arrival of Marmont with superior forces compelled Wellington to withdraw to the Coa, fighting rearguard actions on the 25th and 27th. George Guthrie, now Staff Surgeon of the 4th Division, gives a somewhat pathetic description of the Head of the Medical Department during the retirement.

"The fight was sharply contested. I had now 300 wounded of all arms from the two days without knowing what to do with them, as a further retreat was ordered. At midnight I saw the last of the wounded men out of the village, and at daylight, when near Alfaiates, I found him sitting on a pannier by the roadside, and apparently keeping guard over some twenty or thirty others arranged in a semicircle round him. He was one of the best men in the world, but having slept out all night, looked as unhappy as need be for a man not used to it, and not a little frightened withal. It was impossible to avoid laughing when he quietly said, 'I am here taking care of the medical stores of the Army whilst the apothecary is watering the mules lest the muleteers should run away with them. I have seen a great many wounded passing; are they yours?' I bowed, and asked him if he had told them where to go. No, he had not interfered, for he did not

[1] *Gestation*, that is the conveyance of sick in the open air in carts or carriages, was a recognized form of treatment at the time. Robert Jackson "recommended travelling in boats, carts and carriages on every possible occasion" as part of the cure for contagious fever.

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know where to go himself. I assured him that the French would be up in half an hour. . . . I ventured to recommend Saburgul, as it would be in rear of the position the Army was about to take up, but that I should, with his permission, stop at Alfaiates with my wounded. I also ventured to add that the contents of some of the panniers would be very acceptable; might I take a few things out? 'O yes, I might do as I liked, take anything you please.' 'And you will not disown anything I do?' I added. 'O no, provided you do not disobey orders." This does not show Dr. Franck at his best, however. When he was invalided home five weeks later, Wellington wrote to him that he was much concerned, "and this concern is occasioned not less by my feelings for you personally than by my sense of the inconvenience and injury which the Army and the public interests will suffer by the loss of your valuable services."

In October the Army went into winter quarters dispersed over a wide area. An order issued on the 5th gave strict injunctions that all men unfit to march were to be sent into General Hospital at Celorico.[1] From here they were not to be evacuated further but to be billeted in the villages round. The 1st Division at Guarda were allowed to retain their sick. At this time there were 17,000 sick in a strength of 43,300. The 4th Division had half its strength in hospital. In November there were still 1,400, but as the winter went on things improved. At this time the transport was reorganized. While pack mules still remained the chief source available, a number of wagons were built and the spring wagons of the train became available entirely for ambulance purposes.

On December 24 General Hospitals are mentioned at Coimbra, Abrantes, Castello Branco, and Castanheira. Dr. Franck having gone home, Deputy Inspector Abraham Bolton was officiating as Inspector of Hospitals. The morning state of January 1 shows effective 34,386, sick present 1,410, sick absent 10,345.

(*To be continued.*)

[1] Colonel Hall referring to the crowded state of this hospital and the spread of contagion wrote : "Two patients occupied each bed, and when one died another was brought in to fill his place. From 50 to a 100 were buried daily during the Autumn." Henry's account of the great hospital at Coimbra with its neatly arranged beds, classified according to cases, is a very different one. The French and Spanish were alike impressed with the efficiency of our hospital arrangements as a rule.

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Current Literature.

EVANS, H. M. La vitamine lipo-soluble E et la reproduction chez les mammifères. Communication faite à la Société scientifique d'Hygiène alimentaire le 30 mars 1928. **[Vitamin E and Reproduction in Mammals.]** *Bull. Soc. Sci. d'Hyg. Alimentaire.* 1928, v. 16, 382-97, 16 figs. on 8 plates.

In this communication the author deals with his researches into the discovery, functions, occurrence and properties of the so-termed vitamin E. It has been found that practically normal reproduction results if rats are maintained on a diet of the following composition :—

Casein	27	parts.
Corn starch	59·3	,,
Lard	7·3	,,
Cod-liver oil	2·0	,,
Yeast	0 5-0·7	,,
Salt mixture	4·0	,,

If, however, the content of lard is increased at the expense of the starch, progressively fewer litters are obtained. With 15 per cent. lard, 70 per cent. of the animals remain sterile and with 22 per cent. lard practically all the animals become sterile. Provided the animals have not been maintained for too long a time on this high fat diet, fertility can be restored by feeding a few drops of a fat-soluble extract of wheat germ which is a rich source of the vitamin E. Both male and female rats are affected by these deficient diets. In the case of the male, although the sexual instinct may be preserved, degeneration of the reproductive organs and destruction of the spermatozoa may proceed to such an extent that the sterility produced may be of a permanent nature, no recovery taking place when vitamin E is included in the diet. In the case of the female, ovulation remains normal, but nutrition of the fœtus is interfered with to such an extent that premature death and resorption take place. Response to treatment with vitamin E is always rapid and certain, in this respect the female showing a marked difference from the male.

The reproductive vitamin is widely distributed in nature—chiefly in the vegetable kingdom. The most potent sources are wheat germ and lettuce. Beef and other muscle contain appreciable quantities of the vitamin, whereas milk and cod-liver oil are of little value. The vitamin can be extracted from dried wheat germ with ether, petroleum ether (B.P. 40-60°), acetone, benzene and absolute alcohol. It is stable to heat, wheat-germ oil for instance, heated to 220-250° F. *in vacuo* still preserving its activity. On saponification of the oil, the activity is confined to the unsaponifiable fraction. From this fraction it is precipitated by digitonin.

A. F. WATSON.

Reprinted from "Bulletin of Hygiene," Vol. 4, No. 9.

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RUSSELL, A. J. H., & SUNDARARAJAN, E. R. **The Epidemiology of Smallpox.** *Indian J. M. Res.* 1929, v. 16, 559-638, 45 graphs. [23 refs.]

An attempt is made to answer the questions: (1) What are the circumstances which favour the spread of smallpox? (2) Given identical conditions, do climatic factors have any causal relationship with its spread in different areas?

A severe type of smallpox predominates in India. The diagnosis of this disease may be taken as fairly accurate as regards mortality statistics. Morbidity figures are incomplete, but the considerable differences in case mortality rates which occur in different parts of the country cannot altogether be ascribed to variations in the accuracy of notifications.

The data analysed were the mortality figures from 1866 onwards for 13 areas identical with those used in a similar study on cholera. Smallpox, like cholera, has a seasonal periodicity. Numerous graphs are given which show that in most areas smallpox usually reaches its maximum incidence before the rains and begins to decline after their commencement. Smallpox in India appears to have a periodic trend of about seven years.

Coefficients of correlation were calculated between smallpox mortality and four climatic factors—rainfall, relative humidity, temperature and pressure. Correlation tables and results are published in detail. The first three climatic factors showed a negative association with smallpox. Partial correlations were calculated in order to determine the effect of each climatic factor when the influence of the others was eliminated. The conclusions were that relative humidity was the most important factor. Lack of humidity was directly associated with virulence of smallpox, and in five of the areas this association was only slightly modified by rainfall or pressure. Sir Leonard ROGERS (this *Bulletin*, 1927, v. 2, 419) concluded that an inverse relationship existed between absolute humidity and smallpox incidence. The authors do not confirm this result. After careful analysis they conclude that relative humidity and not absolute humidity is the inhibitory factor. It follows that by noting changes in relative humidity, especially in dry areas, it is possible to forecast epidemics of smallpox well in advance. In the Southern and Central districts of Madras little evidence was found of a relationship between lack of humidity and rise in the incidence of smallpox; for, in these areas, the reason for the steady and exceptionally high incidence of smallpox is the absence or partial failure of the south-west monsoon and the irregularity of the north-east monsoon which in some years is not only delayed but completely fails. It is suggested that low relative humidity consequent on conditions following failure of the periodic rains produces conditions favourable to the development of virulent smallpox.

H. M. WOODS.

Reprinted from "Bulletin of Hygiene," Vol. 4, No. 10.

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GINS, H. A. Pocken in England und Impfschutz in Deutschland. [Smallpox in England and Vaccination in Germany.] *Deutch. Med. Woch.* 1929, v. 55, 1096-7. [6 refs.]

The prevalence of smallpox in England to which so much attention has recently been given in the lay press is not a recent occurrence, but dates back to 1921, as is shown by the following table :—

1921	336 cases
1922	973 ,,
1923	2,504 ,,
1924	3,784 ,,
1925	5,200 ,,
1926	10,000 ,,
1927	15,205 ,,
1928	12,979 ,,
1929 (up to March 17)	3,039 ,,

The disease, however, has not until recently provoked much attention in Germany, because the case mortality was so low, being almost always under 1 per cent. This mild form of the disease is not new, as a similar change in the character of the disease was observed at the end of the eighteenth century and was followed by a return to the severe form. The mild form at present existing in England dates back only 8 years, which is much too short a period to justify the conclusion that a permanent change has taken place in the epidemiological character of smallpox.

The view advanced by anti-vaccinationists that the mild form of smallpox is that peculiar to civilized countries is to be rejected for several reasons. The most important argument is that the so-called alastrim form has also appeared in uncivilized countries such as Africa and Brazil and preserved its character unchanged for many years. Moreover, civilized countries are by no means immune to severe smallpox, as is shown by the severe outbreaks occurring every year in the United States, the Paris epidemic of 1927 and the cases in England due to those imported from India in the *Tuscania* in 1929.

In view of the fact that the great majority of the population in Germany are well protected by vaccination, the author does not think it necessary to demand certificates of recent successful vaccination of those entering the country, as was recently done by the French Government.

In conclusion he points out that the satisfactory condition of Germany as regards vaccination is due to the application of the vaccination law and that no measure can take the place of vaccination as a safeguard against smallpox.

The risks of vaccination are too slight to counterbalance its inestimable advantages.

J. D. ROLLESTON.

Reprinted from "Bulletin of Hygiene," Vol. 4, No. 10.

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TRANSACTIONS OF THE 7TH ANNUAL CONFERENCE OF STATE SANITARY ENGINEERS. **Report of the Committee on Disposal of Sewage and Excreta from Residences.** *Pub. Health Bull. No.* 169, Wash. 1927, Feb., 15-22.

The Committee came to the conclusion that the septic tank was the most suitable device for preliminary treatment of residential sewage. Such tank should not be nearer than 100 feet to a well, and should be on ground sloping away from the same. Sub-surface irrigation of tank liquor is favoured. Sewage flow is taken at 50 gal. per head per day, and tank detention period as 24 hours, tank capacities of 300-400 gal. being desirable for individual installations. Absolute minimum capacity should not be less than 200 gallons. Total depth of liquid recommended in tank is 3 feet: width and length 3 feet and 4½ feet respectively.

For sub-surface distribution of the tank liquor, vitrified stoneware pipes with cement joints are advised, with branches of ordinary land tile laid upon a layer of cinders, gravel or crushed rock. Distance apart of tile drains about 10 feet, with about 12 inches cover of soil. Length of tile line about 150 feet for an average residence.

G. BERTRAM KERSHAW.

Reprinted from "Bulletin of Hygiene," Vol. 4, *No.* 10.

LEHMANN, E. W., KELLEHER, R. C., & BUSWELL, A. M. **A Study of Factors affecting the Efficiency and Design of Farm Septic Tanks.** *State of Illinois Dept. of Registration & Education. Division of the State Water Survey. Bull. No.* 27. 45 pp. 25 figs.

This is a very complete study of the factors concerning the efficiency and design of farm septic tanks, rendered necessary by the introduction of modern plumbing into the farm home, and the consequent demand for the simple and effective disposal of the sewage. The investigators set out to study: (1) The amount and rate of sewage flow that a farm septic tank may be expected to care for; (2) the effect of the size of the tank on its efficiency for a given amount of sewage; (3) the relation of length, width and depth of tank to efficient operation; and (4) the relative efficiency of single and multiple chamber tanks.

The conclusions and recommendations arrived at were as follows :—

Allow from 18-25 gallons per head per day for houses containing respectively 15-7 persons. For a single chamber tank allow 48 hours detention plus 50 cent. additional capacity for sludge, or a total period of 75 hours. For a more efficient plant use a two-chamber tank with 72 hours detention in the first chamber plus 50 per cent. extra capacity for sludge, and 36 hours detention in the second chamber, or 108 hours in all. Minimum sized tank should be large enough for 7 persons. Tank's cross-section should be 3 feet wide with 4 feet depth of sewage. Suitable designs for single and double chamber tanks are given. The single-chamber tank

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might be used where the final disposal of the effluent can be: (1) disposed of by subsoil tiles in porous, well-drained soils; (2) plenty of area available for subsoil tiles; (3) water supply in a well-protected position; and (4) family small—4 to 10 persons. For other conditions, the two-chamber tank is recommended for best results.

The paper is well furnished with tables and cuts.

G. BERTRAM KERSHAW.

Reprinted from "Bulletin of Hygiene," Vol. 4, No. 10.

HOTTINGER, A. Ueber die künstliche Ernährung des Säuglings. [The Artificial Feeding of Infants.] *Schweiz. Med. Woch.* 1929. Feb. 2, 97-105. [Children's Hosp., Basle.]

No absolutely satisfactory substitute for the mother's milk has yet been found. The rapid increase in weight and the relatively great surface area of the nursling account for its increased food intake and the peculiar aspects of its metabolism. Fermentation with lactic acid production is physiological, whereas *Bact. coli* fermentation with acetic acid production and putrefaction is definitely harmful. Sporadic appearances of *Bact. coli* in the upper small intestine and stomach account for some of the cases of dyspepsia in infants. Excess of albumin in the food is harmful, for, especially when in the form of calcium compounds, it checks fermentation, promotes putrefaction and acts as an astringent. It is upon this astringent effect that the reputation of Finkelstein's albumin milk partially depends. The protein content of the food has an important influence on the fat metabolism and for this reason simple increases of fat in the diet are not always successful. The growing organism demands large amounts of carbohydrate and the younger it is the more it requires. Lactose is the ideal carbohydrate and should form about 7 per cent. of the diet. It should be recognized that periods of relative or absolute thirst are as dangerous to the growing infant as are periods of hunger. Vegetable broths obtained from the cooking water of spinach, carrots, potatoes or cabbages are occasionally used in infant feeding. Vegetables and raw foods are not added until the 5th or 6th month. Butter milk with its finely flocculated casein coagulum and poor fat content is excellent for nursling infants.

H. N. H. GREEN.

Reprinted from "Bulletin of Hygiene," Vol. 4, No. 10.

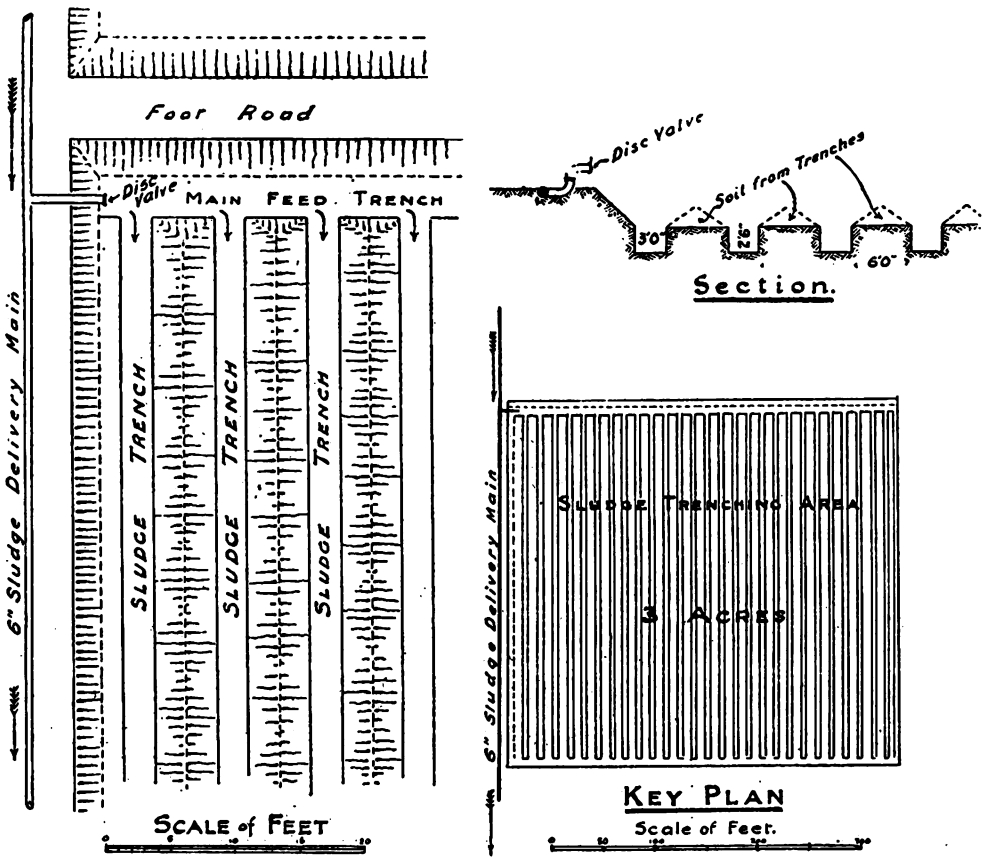
GARNER, J. H. Sewage Sludge. *Surveyor.* 1928, v. 74, 465-9, 2 figs.

This is an important paper dealing with various methods of sludge disposal.

The author stresses the importance of local conditions as affecting the problem. He finds that the disposal of wet sewage sludge upon land, either by ploughing or trenching, is one of the best and cheapest methods. Figs. 1, 2 and 3 show the method of sludge trenching in use at Wakefield. Mention

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is made of a small motor-driven cultivator (the Rototiller) used at the Honley and South Crosland Sewage Works for incorporating the sludge with the soil. This machine, costing about £200, will turn up an acre of land 5-6 inches deep in 5 hours, working in top gear. In bottom gear one acre can be worked 10 inches deep in 9 hours. The cost per acre is stated to be about 12s. for labour and fuel when cultivating 5-6 inches deep.



Sludge trenching at the city of Wakefield's main sewage works; lay-out of land in plots, method of construction of trenches, and manner of distribution of sludge.

[Reproduced from the *Surveyor*].

When working 10 inches deep the cost is 24s. At Wakefield, the sludge is derived from a population of 47,000 and a d.w.f. of sewage of 2½ million gallons, half of which is trade wastes derived from the textile industries. 80 tons of precipitated sludge containing 95 per cent. water are dealt with daily by trenching; the total area used being 18 acres of fairly stiff clay, or 1·8 sq. yards per person. The sludge is pumped into the trenches from time to time, until they are full to original ground level with sludge

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containing from 65 to 70 per cent. moisture. New trenches are then cut between the original ones. Cost of labour per yard length of trench is 5½d. Cost of sludge disposal is 6½d. per cub. yard of 65 to 70 per cent. moisture sludge, or about 2d. per cub. yard of 90 per cent. moisture sludge. The second time the land is sludged the trenches are cut at right angles to the original ones.

Mr. Garner also discusses sludge filters, sludge pressing, aids to dewatering, sludge digestion, preparation of sewage sludge as a fertilizer, and sludge utilization from a national standpoint. The paper should be read *in extenso* by those interested in the subject.

G. Bertram Kershaw.

Reprinted from "Bulletin of Hygiene," Vol. 4, No. 10.

Reviews.

The Operations in Egypt and Palestine, 1914 to June, 1917. Illustrating the Field Service Regulations. By A. Kearsey, D.S.O., O.B.E., *p.s.c.* Late Lieutenant-Colonel, General Staff. Aldershot: Gale and Polden. 1929. Pp. 69. 11 sketches. Price 3s.

This is a résumé of and a commentary on the situation in Egypt and Palestine, from the outbreak of the war until the close of the second battle of Gaza, when General Sir Edmund Allenby assumed command of the E.E.F.

It is a companion summary to the same author's "1915 Campaign in France." It is arranged in the same manner, and published in the same style. A comparison between the two little books is therefore inevitable.

Both show how the process of condensation can be carried to a fine art. One can hear some readers exclaim, "Admirably condensed!" and others, "Hopelessly congested!" depending on their respective requirements and points of view.

Both indicate painstaking research and careful compilations, they are technically excellent; but whereas the western summary is a thing of technique and exactitude, the eastern is a thing of technique and life. In the latter the author seems to be nearer his subject.

The explanation of this important difference will be found on comparing the notes at the beginning of each book:—

(France)—". . . compiled . . . from information received."

(Egypt and Palestine)—". . . compiled . . . from notes made personally."

Verily, *on n'est jamais si bien servi que par soi-même.*

As a "cram," an aid to memory, or a miniature work of reference, this little book is of value. A.

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SOME PRINCIPLES OF MINOR SURGERY. By Zachary Cope, M.S., M.D.Lond., F.R.C.S.Eng. Humphrey Milford, Oxford University Press. 1929. Pp. xi + 159. Price 10s. 6d.

In this volume the author "endeavours to lay stress upon certain elementary general principles of surgery which are sometimes in danger of neglect."

The volume is divided into eight sections. The first chapter is on the use and abuse of antiseptics, which is of exceptional interest, especially to those in the Service. There is a considerable amount of discussion about gunshot wounds and their treatment. Stress is laid on the infection of the bullet track, especially where fighting is on highly manured soil, and primary wound excision is advised as the ideal method of treatment where possible. There is no mention of the extremely useful method of delayed primary suture, nor is it quite brought out that the chief difference in the types of wounds in the Great War, as compared with previous campaigns, was due to the enormous increase of shell fire, bombs, grenades, trench mortars, etc., and that the worst type of wounds were those due to the relatively low velocity missiles as compared with high velocity bullet wounds.

Carrel Dakin's treatment is dismissed in less than two pages, and this is a method in which minute attention to detail is essential for success.

The whole question of the use of antiseptics is most thoughtfully discussed. It is good to see that the hypochlorites, the flavine derivatives and saline are all favourably mentioned.

Of the other chapters, the one on "Infections of the Hand" is extremely useful, and, as the author states, "an attempt is made to summarize the work of Kanavel."

There is a large amount of information in the chapters on "Sprains" and "The Treatment of Ambulatory Fractures" of a type that is not obtainable elsewhere. In fact, every chapter is very well worth careful study. The volume is of a handy size, easy to read, and well illustrated. J. M. W.

CLINICAL PROCTOLOGY. By W. E. Minor, M.D. London: H. Kimpton. 1929. Pp. 258. Price 42s.

The examination and treatment of conditions affecting the rectum and anus require a meticulous care if good results are to be obtained.

Dr. Minor has written a most helpful book on clinical proctology, a study of which cannot fail to stimulate the interest of all who are surgically inclined. Nothing has been left to chance in his description of the various conditions he describes. The detail given in the text is unusually full, and the excellent illustrations, of which there are one hundred and thirty-six, make reading very easy. Dr. Minor is obviously an enthusiast on the subject of local anæsthesia, and for many operative procedures, particularly in the case of hæmorrhoids, fistulæ, etc., he gives in great detail the measures necessary for its use.

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In all respects the book is admirably got up, and Dr. Minor is to be congratulated on its production.

It is a book not merely to read but to have at hand for constant reference. J. H. M. F.

MILITARY LAW. By Lieutenant-Colonel S. T. Banning, C.B.E. Seventeenth Edition. Aldershot: Gale and Polden, Ltd. 1929. Pp. xxv + 314. Price 8s. 6d. net.

This book needs no introduction to those of our readers who have struggled with examinations in military law, and its value has been generally recognized since the first edition was published over twenty-eight years ago under the title "Military Law Made Easy." This, the seventeenth edition, has been made necessary by the publication of the new official "Manual of Military Law," and the author, while making the required amendments to references and adding notes on new matter, has taken the opportunity to recast some of the chapters and to amplify the index.

THE AFTER-TREATMENT OF OPERATIONS. By P. Lockhart-Mummery, F.R.C.S.Eng. London: Baillière, Tindall and Cox. 1929. Pp. ix + 287. 37 figures. Price 7s. 6d. net.

With the enormous output of works on surgery it is somewhat surprising that more is not written on the very important subject of post-operative treatment. Fortunately for our patients the surgeon of to-day is not content to consider his responsibilities at an end when the last suture has been tied and the dressing applied.

A sound knowledge of possible complications, which may follow on the most meticulous observance of surgical technique, is demanded of him.

Such an aid to the surgeon's endeavour is present in the book before us. It is well written and well balanced, and what is more important it is practical. Mr. Lockhart-Mummery is to be congratulated on the issue of a fifth edition of his deservedly popular book.

THE USE OF STANDARD TREATMENTS IN THE CAMPAIGN AGAINST DISEASE IN THE TROPICS. By J. Neil Leitch, M.D., D.T.M. and H. With an Introduction by G. Carmichael Low, M.D., F.R.C.P. H. Lewis and Co., London, W.C. Price 6s. net.

This thesis is warmly commended to those medical practitioners in the tropics who find themselves in medical charge of large numbers of native workers employed in factories, tea plantations, rubber estates, and the like.

The actual system suggested by the author will, however, be quite familiar to those members of the profession who have been in medical charge of a military unit in peace or war, entailing as it does a medical history sheet for each member of the unit in which the necessary entries are made and a system of follow-up is permitted.

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But it is in the adoption of the actual specific treatment that the main value of the work lies, for the author gives the evolution of, and the latest known treatment for, five of the commoner diseases met with in the tropics—malaria, kala-azar, cholera, ankylostomiasis, and amœbiasis.

In the selection of any type of mass treatment, the author rightly stresses the importance of considering the easiest source of supply and the expense involved in obtaining the necessary specific drug.

Although the number of diseases dealt with is small, the author has succeeded in laying down a framework which can be built up to suit conditions and diseases endemic in other regions of this earth. The work contains illustrations which will give the reader a good idea of the type of hospital, type of patient, and the general surroundings in the author's sphere of activities in Assam. R. P.

PHYSIOLOGY OF THE CENTRAL NERVOUS SYSTEM AND SPECIAL SENSES. By N. J. Vazifdar, L.M.S., F.C.S., F.C.P.S., Bombay. Fifth Edition. Calcutta: Thacker, Spink and Co. 1929. Pp. vii + 301. 30 illustrations.

The appearance of a fifth edition of this volume is an indication of its value to medical students preparing for their intermediate examinations.

It is a very ably written résumé of the subject-matter of the larger textbooks, illustrated by many simple and clear diagrams. Various tabulations enhance its value for examination purposes.

We can recommend it as a real help to the student.

ESSENTIALS OF MEDICAL ELECTRICITY. By E. P. Cumberbatch, M.A., B.M.Oxon, M.R.C.P. Sixth edition. Pp. 443, with 11 plates and 116 illustrations. London: Henry Kimpton. 1929. Price 10s. 6d.

The first few chapters deal in a masterly manner with the elementary facts of the different currents used in medical electrical treatment, also with the electric main, its dangers and how to avoid them. A study of these would well repay those whose readings do not normally include electricity. The author has a refreshing way, while going through the various uses of medical and surgical electricity, of saying clearly what is out of date and is little used now. Galvanic acupuncture has a brief chapter, and it is presumed this is all it merits. R.D., the reaction of degeneration, a bugbear to many, is discussed at length, and this should cease to be a stumbling-block after careful perusal of these pages. It is noteworthy to see clear statements regarding the rheobase and chronaxie, but it is doubtful whether their usefulness to the average electrologist balances the effort of estimation. Diathermy is now the accepted name for high-frequency thermo-therapy and it properly fills seventy-five pages, and special attention is directed to the free use of surgical diathermy and fulguration, admirable weapons not sufficiently used. Static electricity is more spectacular in its effects and no doubt is worthy of application in suitable cases.

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This book is invaluable and a better one cannot be recommended to students of this subject, and especially those going up for any of the electrological diplomas.

THE HISTORY AND TRADITIONS OF THE MOORFIELDS EYE HOSPITAL : ONE HUNDRED YEARS OF OPHTHALMIC DISCOVERY AND DEVELOPMENT. By E. Treacher Collins. London : H. K. Lewis and Co., Ltd. 1929. Demy 8vo. Pp. xii + 226. 27 plates. Price 12s. 6d. net.

This volume, though most interesting to those who have studied at Moorfields, will be appreciated by a much wider circle of readers, for a history of Moorfields must be a recital of the developments of ophthalmology during the period of its most rapid advance.

Mr. Treacher Collins is well qualified to write on the subject. He has been on the staff of Moorfields for over thirty-five years, and besides having a thorough knowledge of its history, he is obviously inspired with a love for the institution and all it has meant for ophthalmology, and has the faculty for expressing himself clearly and interestingly.

The plates with which the volume is illustrated are mainly reproductions of engravings and photographs of distinguished members of the staff and of the buildings.

A SHORT HISTORY OF THE ROYAL ARMY MEDICAL CORPS. By Colonel Fred Smith, C.B., C.M.G., D.S.O., R.A.M.C. (Retired Pay). 1930. Aldershot : Gale and Polden, Ltd. Pp. xii + 111, with 5 plates. Price, in paper binding, 1s. 6d. ; in cloth binding, 2s. 6d. Postage 3d.

"This History has been written for the use of young soldiers of the Corps, at the Depot, who have to pass examinations in the subject in order to qualify for the 3rd Class Certificate of the Army Educational Department." This statement of his object by the author is, perhaps, surprisingly prosaic. Those of our readers whose lives are bound up in the Corps will find a more congenial note in the remark of Sir Matthew Fell, in his brief foreword : "The little book supplies a much felt want, and all of us who read it will feel that we owe him (the author) a debt of gratitude."

We shall not attempt to describe here in any detail the arrangement of the book, which should be studied by all interested in the Corps. The earlier chapters, dealing with the evolution of the idea of organized assistance to the sick and wounded, review briefly a large number of histcrical facts. In the later chapters the accounts of changes and the reasons for them are fuller and more vivid, and stirring accounts are given of instances of efficiency and devotion to duty.

In the Great War the Corps was enormously expanded, and its strength rose from 9,000 to 133,000 at the end of the war. It served in many theatres and dealt with some 9,000,000 sick and wounded soldiers.

The best testimony to its work is perhaps the fact that 1,600,000 men on the Western Front alone were saved to the Army and returned to the fighting line.

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Colonel Smith pays a tribute to the work of the Special Reserve and the Territorial Force. He writes: "In every theatre of war the formations of the Reserve and of the Force (Territorial) which served *in their* entirety in the field were equal to the best." In 1914 the strength of the R.A.M.C.T.F. was 12,500 and at the termination of the war 31,580; 246 complete units served overseas. The services of the Force were recognized by the G.O.C.'s. in C. and the members were well represented in the various honour lists.

As befits a historian, Colonel Smith has restrained his pen, and the accounts of awards of the Victoria Cross and other distinctions are, for the most part, extracts from the *London Gazette*. They lose nothing in impressiveness for this.

The author acknowledges assistance from past and present officers and other ranks, and especially that of Lieutenant-General Sir *Charles H.* Burtchaell.

It has been arranged that any profits accruing from the sale of the History will be devoted to Corps charities.

Correspondence.

HOSPITAL ACCOMMODATION IN THE FIELD.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—After reading the many examples which have been given in the Journal, from time to time, of how to write a medical appreciation of a military operation, the following observations occur to me. Can we rely for the calculation of casualties, and consequently the hospital accommodation required, on the basis which is in use at the present time?

Take, for instance, the calculation of wounded. Is Cron's estimate that three-fifths of the force will be engaged still correct? When we consider the increase in range of the artillery and the introduction of air warfare, surely one may be excused for being somewhat doubtful as to its accuracy.

Again, can we depend on the proportion of killed, severely wounded and lightly wounded being the same as in the Austro-Prussian War some sixty years ago?

Turning to the question of sick, on what is the daily figure of three per thousand founded? From perusal of the "Official History of the War," it is difficult to come to any definite conclusion as to the number for whom accommodation was required on the Western Front. Figures are, however, given for the campaign in South-West Africa, and these indicate that during the 375 days which that campaign lasted the daily admission-rate to hospitals was two per thousand, under conditions which would appear likely to give a figure above, rather than below, the normal for operations in a temperate or subtropical climate.

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In addition, is the calculation that 40 per cent will require hospital treatment for one week, 50 per cent for three weeks, and 10 per cent will require evacuating, founded on actual statistics or is it merely an assumption?

From the above it will be seen that difficulties must arise in justifying figures given in an appreciation, unless it is possible to quote from the experience gained in the late war.

Might I ask if any statistics have been published dealing with these points and, if not, if there is anyone among your readers who has had access to the official figures and would be good enough to throw light on the subject?

It would be of the greatest assistance to many of us to be given figures, based on recent data, from which we might calculate the numbers of (*a*) sick, (*b*) wounded, that we may expect, not only in a large European war, but also in small wars in which we are likely to be involved in other parts of the Empire.

Further, is it not possible to do away with the present tedious method of calculating the number of beds required for sick, so that, having decided on the number of daily sick to expect, we shall at once be able to say the number of beds eventually required for the force, i.e., if the daily rate was five per thousand the accommodation necessary would be 7 per cent of the whole force?

Finally, taking into consideration that the number of beds required for sick and wounded in general hospitals is laid down in R.A.M.C. Training, 1925, as 10 per cent of the force, cannot this be accepted as final, for presumably it was founded on experience?

Headquarters,
British Troops in Egypt,
Eden Palace Hotel, Cairo,
December 5, 1929.

I am, etc.,
D. REYNOLDS,
Major, R.A.M.C.

Notice.

YATREN PREPARATIONS.

YATREN is best known to our readers as a drug which has established itself as a valuable weapon in the treatment of amœbic dysentery. It is claimed that it is non-toxic and non-cumulative, and in these respects has many advantages over emetine. For oral administration it is supplied in the form of pills, and solutions of the powder may be used for rectal injections.

A further application of its antiseptic qualities and high iodine content is made in "Yatren Wound Powder," which contains ten per cent of propaesin. It is odourless and causes no pain and is intended for use as a dusting powder on septic wounds and ulcers.

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VOL. LIV. MARCH, 1930. No. 3.

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Journal
of the
Royal Army Medical Corps.

Original Communications.

WRITING AN APPRECIATION OF A SITUATION.

SOME NOTES ON THE SUBJECT FOR OFFICERS OF THE ROYAL ARMY MEDICAL CORPS.

[*See Training and Manœuvre Regulations, Section* 25.]

BY LIEUTENANT-COLONEL W. G. LINDSELL, D.S.O., O.B.E., M.C., *p.s.c.*, *Royal Artillery.*

SOME people when they are called upon to write an appreciation of a situation find themselves wondering how to begin. One is rather taken aback by the mouthful of words, "an appreciation of the situation"; there is a feeling that something quite out of the ordinary has been asked for. The making of an appreciation is, however, consciously or unconsciously, a matter of daily and hourly routine with every one of us.

The medical practitioner diagnosing a case and deciding on its treatment; the policeman directing the traffic at a cross-roads; the individual arranging his afternoon's golf is doing nothing more or less than making an appreciation of the situation, considering perhaps the various ways by which he can get to the links by car, by bicycle, on foot, or by train, the time at which he must start, and a number of minor details and eventually deciding on his plan. In some cases it is only a matter of a moment's thought, in others a full examination of many factors may be necessary.

The habit of making and writing appreciations is a valuable exercise for an officer; it teaches him to arrange his facts methodically and trains him to arrive rapidly at a logical and sound conclusion.

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Briefly stated, the process of making an appreciation consists of the following stages:—

(*a*) First decide on your object. Sometimes it is quite clear, in more complicated cases it must be deduced.

(*b*) Next consider by what different ways you can attain your object, and the advantages of each.

(*c*) Then consider the objections to these different ways. In a military appreciation this includes what the enemy may do to prevent you attaining your object.

(*d*) You can now choose what you consider to be the best way of attaining your object.

(*e*) Finally, decide how to carry out the chosen method; this constitutes your plan.

In the process of considering the various courses open to you and to your enemy, an examination will have to be made of all the factors bearing on the situation and deductions arrived at from this examination. A commander in the field has to consider the factors of time and space, relative strengths of opposing forces, topographical and climatic conditions, vulnerable points, supply, transport, communications and similar subjects. A director of medical services, in studying his particular problem, would also have to consider some of the same factors, but not all of them. A surgeon about to perform an operation would have quite a different set of factors to deal with. It is not the factors themselves that are of chief consequence, but the deductions we make from them that decide our choice of a course of action. In a written appreciation we should rigorously exclude anything that has not a definite bearing on the particular problem and is not essential to its solution. In a battle the problems of the commander of a field ambulance and of the A.D.M.S. of a division, though they have certain points in common are not the same. Certain factors will affect the appreciation that each would make; all the factors would not affect them both nor in the same degree. Each case must be treated on its merits.

The actual form which a written appreciation takes is of considerable importance. The object aimed at is that it should be perfectly clear, and the arguments should lead logically to the conclusion arrived at.

It is sometimes necessary to make detailed calculations regarding transport facilities, for example, or to describe climatic conditions at different times of year. It will generally add to the clearness of the appreciation if all such details are put in appendices and the broad deductions only are set out in the body of the paper.

As an illustration of the form which might be adopted, an appreciation is attached of a purely imaginary situation, which is supposed to have arisen as the result of a decision to despatch an expeditionary force to carry out a landing, in conjunction with the Navy and Air Force, in the

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territory of "EREHWON," where operations will be conducted in co-operation with our ally X-land.

This example should not be used as a fixed form to be followed in every case; it would probably be quite unsuitable for, say, the appreciation that the A.D.M.S. of a division might make prior to some major tactical operation on land; it is given merely as an illustration of the application of the principles referred to above, to a particular type of operation. It is not claimed that the following appreciation gives a correct solution of the problems facing the Medical Service. It is merely illustrative of the form such an appreciation might take.

Some notes are added at the end explanatory of the proposals put forward.

SECRET.

Appreciation of the situation from the point of view of the Director of Medical Services arising out of the decision to dispatch an expeditionary force to EREHWON, *to co-operate with X land.*

LONDON,
April 1, 1929.

(1) *The object* of this appreciation is to assess the responsibilities of the Medical Service arising out of the conditions of the campaign and to determine the medical organization required to meet those responsibilities.

(2) *The Size of the Force.*—The force is to consist of two divisions, with a proportion of non-divisional and L. of C. troops, and a R.A.F. contingent, with an approximate total strength of 50,000, all ranks. Apart from battle casualties this presupposes a normal daily sick-rate of 150; in addition, the Royal Navy, operating in conjunction with the Army, may call upon the Army to provide for a daily sick-rate of 100.

(3) *The climatic conditions* and diseases arising therefrom which are liable to be encountered are summarized in Appendix I attached, from which it will be seen that no special scale of rations is required unless operations should be prolonged into the winter; that the normal scale of clothing is suitable with the addition of certain special items of which the scale of issue recommended is stated in the same appendix.

(4) *Geographical and Topographical Considerations.*—Apart from climatic conditions, the outstanding topographical considerations are the lack of road and railway facilities of the proposed theatre of war, and the very limited port facilities at the proposed point of landing. This calls for all motor ambulances being of the six-wheeled type, and for the provision from naval sources of suitable hospital small craft for the conveyance of sick and wounded to and from hospital ships and landing places; it is considered that ten such craft should be provided as tenders to each hospital ship; they will be of the utmost value for the evacuation of casualties in the early stages of the initial landing.

Another topographical condition of great importance is the question

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of water supply in the area. Intelligence is lacking, but there is reason to suppose that water is available in ample quantity though its quality is open to very considerable doubt. From a medical point of view, if not from other aspects, this calls for the provision of water as an article of supply from approved sources, in the first instance, and very early arrangements for adequate water reconnaissance upon which medical officers should serve.

(5) *The General Organization of the Lines of Communication.*—The distance from the home base in the United Kingdom to the advanced naval and air base on WHATHO Island is nine days' steaming. From WHATHO Island to PORT WISHFUL, in the vicinity of which place the landing is to be effected, is approximately eighty miles. On WHATHO Island, in addition to R.N. and R.A.F. installations, there will be certain military base installations such as personnel camps, remount and veterinary establishments, etc., and a minimum of fighting troops, chiefly anti-air defence units.

On the mainland, in addition to the two divisions and certain non-divisional troops, there will be base installations containing all kind of maintenance stores. These latter installations, however, by special arrangement with our Allies, are to be kept to an absolute minimum consistant with tactical necessity and the security of maintenance. As much as possible of the limited space available in the vicinity of PORT WISHFUL is being reserved for the use of our Allies.

In consequence of the above the medical requirements of the troops on the mainland will be met by the normal medical units included in formations and by the necessary number of casualty clearing stations, while general hospitals are opened on WHATHO Island.

Sufficient and suitable hospital ships, having regard to navigational difficulties in the vicinity of WISHFUL, will be required :—

(*a*) For evacuation from the mainland to the hospital centre on WHATHO Island ; and

(*b*) For evacuation from WHATHO to the home base. For these purposes two large and two small hospital ships are considered necessary.

(6) *The General Nature of the Tactical Operations Contemplated.*[1]—These include a short period of special training somewhere in the home area, an unopposed landing of certain units on WHATHO Island, an opposed landing in the vicinity of PORT WISHFUL and subsequent operations on the mainland to an approximate distance of some twenty miles from the point of landing. It is anticipated that the British force will be withdrawn before the winter sets in.

(7) *The Number and Nature of the Casualties Anticipated.*—In the

[1] This is of course not a part of the D.M.S.'s appreciation, but is taken from the General Staff appreciation. It is included to show that there are four distinct periods involved in the operations as a whole, for each of which medical arrangements have to be thought out and provided for.

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event of the initial landing being opposed, this is the stage in the campaign when battle casualties are expected to be at their greatest. The General Staff estimates these casualties at fifteen per cent. of the troops actually engaged, say 1,500 on the day of the landing. There is, in addition, the probability that the enemy will use gas; the number of medical units included in the organization of the force must therefore admit of the segregation of gas casualties.

(8) *Plan.*—The medical arrangements to meet the four stages of the operations and to deal with the casualties anticipated will be planned on the following lines:—

(*a*) All medical unfits will be disembarked in the home area prior to the sailing of the expedition from final rendezvous.

(*b*) A C.C.S. will be landed immediately on WHATHO Island to provide for essential services pending the establishment of a hospital centre on the island.[2]

(*c*) Arrangements for medical services at the initial landing will be made by the D.D.M.S. of the force with the units at his disposal.

(*d*) Two, subsequently three, C.C.S.'s will be opened on the mainland in the vicinity of PORT WISHFUL as soon as tactical conditions admit, and one motor ambulance convoy (less one section on WHATHO) will be made available for the service of mainland formations.

(*e*) General hospitals will be established on WHATHO Island[3]

(9) In view of the above considerations the following medical units should be embarked with the force in addition to those normally included in formations; the units are shown under their proposed destinations:[4]—

MAINLAND.	WHATHO ISLAND.
1 Field Ambulance, Non-divisional.	1 Section Motor Ambulance Convoy.
1 Motor Ambulance Convoy (less 1 Section).	1 Hygiene Section.
1 Advanced Depot of Medical Stores.	1 Mobile Laboratory.
3 C.C.S.'s (one temporarily on WHATHO Island).	1 Base Depot of Medical Stores.
	3 General Hospitals (1,200 beds).
	1 Convalescent Depot.

Two large and 2 small Hospital Ships based on WHATHO Island.

(10) In addition to the above, cleansing and disinfection units will be required both on the mainland and on WHATHO Island.

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[2] This is not necessarily the best solution, but it is important to state definitely at this stage what arrangements are proposed for the immediate provision of hospital accommodation, in order that the branch of the staff concerned may make the best arrangements possible for embarking the medical units in a correct order of priority, and for their inclusion in the correct convoys in accordance with the destination and order of arrival of each.

[3] The order adopted is in the same sequence as events will follow in practice.

[4] The field ambulances and hygiene sections which are included in the normal organization of divisions are not mentioned; they would of course be embarked with the formation to which they belong.

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Appendix I.

NOTES ON CLIMATIC CONDITIONS PROBABLY TO BE EXPERIENCED, AND ON SUITABLE CLOTHING AND RATIONS FOR THE TROOPS.

(1) The climatic conditions to be expected in EREHWON may be summarized as follow :—

April-May.

(*a*) Weather conditions approximate those of NORTH SCOTLAND in same period but more humid, and dense fogs are an outstanding characteristic.

(*b*) The clothing of our men is eminently suitable for this period, but extra socks, mufflers and warm gloves will be required. Fur or leather coats, ear caps and gauntlet gloves should, if possible, be provided for all vehicle drivers.

As the snow will be melting, gum boots or loose (German) boots will prove useful, particularly for personnel engaged on guards, picquets and other exposed duties at nights. Extra blankets will be required in bivouacs and billets, to be withdrawn as weather improves.

(*c*) The authorized field ration is satisfactory and, if cocoa is added during this period, should prove very suitable.

June, July, August.

(*a*) High temperature (75° to 90° F.) with marked humidity is common. There is little darkness at night, and owing to trying conditions of day-time, work is often largely conducted at night.

Heavy rains may be expected during August.

(*b*) Our clothing is quite suitable, but cotton underclothing is essential, and cap screens (protection against sun) are desirable.

(*c*) The authorized field ration is suitable.

September-October.

This period approximates to our winter season. September may remain mild, but October usually is severely cold.

See notes under April-May.

Mosquitoes and gnats abound at all seasons. Nets, curtains, etc., are practicable only under certain conditions, but repellent oils should be available for all troops—particularly for those on guard, picquet and outpost duties.

Should the occupation extend into the cold season, special clothing will be necessary, and the Shackleton food ration should be authorized.

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(2) *Diseases which may Adversely Affect Man-Power.*

(*a*) Our force should be 100 per cent inoculated against enteric fever.

(*b*) Dysentery, epidemic diarrhœa, and even sporadic cholera may result from any deviation of Hygiene Orders, as the melting of the snow results in highly insanitary conditions and ready pollution of water.

(*c*) Typhus and relapsing fevers will certainly occur if thorough body cleanliness and ample washing and disinfecting arrangements are not provided.

(*d*) Malaria will probably not prove a serious danger, but heat stroke and sun exposure during the warm months must be guarded against.

(*e*) Venereal disease is an outstanding danger, and definite and comprehensive action should be taken to obviate possibly very serious loss of man-power from this disease.

It is considered that:—

(i) The climatic conditions, although very trying, should present no great obstacle to success;

(ii) If practical measures are taken to guard against obvious sources of infection, disease should not prove a menace to the success of the Expedition.

(3) *Cleansing and Disinfestation.*

Cleansing and disinfestation units will be essential for duty with all troops, and should be included in the "Order of Battle."

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PORTABLE DISINFECTORS AND DISINFESTORS.

By Major A. C. HAMMOND SEARLE, M.C.,
Royal Army Medical Corps.

The utility of efficient portable disinfectors can be considered as definitely established, and such devices are playing an increasing part in the prevention of disease in civil and military life at home and abroad.

Originating largely from the endeavour of officers of the Royal Army Medical Corps to fulfil military medical requirements, their use has been found applicable to civil conditions, and well-known civilian firms have taken up their manufacture.

Military and civilian members of our profession, finding their way from many different countries to the Army School of Hygiene, have been responsible for many conflicting statements in regard to their use and efficiency, and several discrepancies are apparent when the available literature on the subject is consulted.

Investigations have been carried out on : (1) The Lelean (Sack) Portable Disinfector ; (2) The Drum Disinfector—designed at this School ; (3) The Serbian Barrel (Downward Displacement) ; and the following are some of the conclusions that have been arrived at :—

(1) The Lelean (Sack) Portable Disinfector.

It should not as a rule be necessary to protect this apparatus by covering the sack with turf and the like in order to conserve heat and prevent the escape of steam.

It has been repeatedly and successfully worked in cold weather and in a strong wind suspended from a gibbet by a wire hawser.

In England the apparatus will withstand regular work for a period of months (according to frequency of usage) before showing signs of deterioration, viz., a worn appearance of the painted canvas and escape of steam.

The efficiency of the bag is easily and practically restored by application of the special paint or dope issued for the purpose.

The composition of this restorative preparation is being kept secret by the firm supplying it, but there should be no great difficulty in obtaining an equally efficient substitute.

It is considered that the discordant results obtained by various workers in different parts of the world are largely due to the fact that the sacks used have not been kept sufficiently steam-proof by applications of this dope.

Composition of the Sack.—This is made of stout Willesden canvas, and, although experiments have been conducted at this School with the object

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of improving on it as regards durability and heat conservancy, none of the various substances tried and manufactured experimentally has been found to be superior to Colonel Lelean's original design and material.

Capacity of the Sack.—All experiments have been conducted with Army blankets only, and of these the sack takes twenty-five, when properly packed. A smaller number is not a full load, and a larger number is inadvisable.

The blankets should be evenly and fairly tightly packed in the sack, a useful implement for ramming them in being a broom handle. This number of blankets (twenty-five) has been shown to be efficiently sterilized whatever the source of heat employed, with the following exception and possible fallacy: It cannot be considered as certain that the whole outer surface of the last blanket will reach a temperature of 212° F., owing to possibly unskilful cording up of the bag, and it is therefore advisable to re-sterilize this outermost blanket.

Tests of Sterilization.—Throughout these experiments the following tests have been employed :—

(1) Temoine tubes melting at 100° C. (exalgin and methyl-violet).

(2) Two maximum and minimum thermometers.

(3) Phipson's apparatus [1].

In each experiment :—

(*a*) One maximum-minimum thermometer has been wrapped in a small piece of sheeting together with two temoine tubes, and placed near the bottom of the sack (before inversion) on the first blanket inserted, i.e., practically on a level with the point of entry of the steam.

(*b*) A similar couplet near the middle of the sack.

(*c*) Phipson's apparatus just under the outermost or last packed blanket, i.e., near the mouth of the sack.

In all successful experiments the temperature reached in the thermometers has been 212° F., all temoine tubes have been found to be "gone," i.e., the dye has been distributed throughout the small capillary tubes by the melting of the exalgin, and the alloy of the Phipson apparatus has been melted, as indicated by the ringing of the electric bell.

It can be taken as proven that in a disinfector of this nature, working by downward displacement, every portion of the contents is exposed to pure steam unmixed with air at a temperature of 212° F., which is far from being the case in apparatus in which there is an admixture of air with the steam, the latter being allowed gradually to replace the former.

It is considered permissible to stress this point by recalling the results of certain former experiments, [2] and [3], in which it was shown that a number of sporing organisms, including *B. anthracis*, were killed by exposure to steam in the Lelean Sack for periods of four to five minutes, calculated from the moment of emergence of steam from the bottom of the inverted sack. It may be noted that with a normal load and normal rate of steam production (as, for example, by means of the paraffin and air-

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pressure lamp issued with the apparatus) it will take from sixteen to twenty-two minutes and upwards for steam to emerge from the bottom of the sack, reckoned from the moment that the hose, with steam issuing freely from the boiler, is attached to the sack.

It is considered that to ensure sterilization of the contents, steam should be allowed to continue to pass through for at least five minutes after its first appearance at the bottom of the sack, for the following reasons :—

(*a*) It is certain that near the bottom of the inverted sack a temperature of 212° F. is occasionally not reached for several minutes after steam has first issued, since a variable time (from nil to five minutes) may elapse before the bell of the Phipson apparatus rings.

This is due, not so much to intrusion of cold air through an improperly corded sack, but to unusual protection afforded to the Phipson apparatus by packing the last blankets before inversion too tightly, or insufficient steam pressure, which is unable to force its way through the load at a normal rate, or possibly at all.

The importance of maintaining an adequate head of steam was particularly clearly demonstrated in some of the experiments quoted below, and will be again referred to.

(*b*) If steam is allowed to pass for a further five minutes there is a greater probability that any sporing organisms that may be present will be killed by the more prolonged exposure. In any case it is self-evident that traces of steam may find their way out below through paths of low resistance without the whole contents of the bottom of the sack being sterilized, and that it is essential to avoid this error by laying down a sufficient "safety margin."

The results obtained by this apparatus, as issued, are considerably influenced by some of the following points, and attention to detail is essential to success :—

(1) *The Boiler and Heater.*—(*a*) It will be remembered that the boiler is an oblong copper vessel of which the under surface is hollowed out over the actual flame into a saddle-back shape, thereby promoting speed of heating. This boiler has been stated to hold 7 to 8 gallons; this is incorrect, and its capacity is 6½ gallons only.

It has also been found that, if this amount of water is employed, there is considerable loss by boiling over or priming of the steam hose.

The introduction of pieces of pumice into the boiler with the object of avoiding bumping effected no improvement. When priming occurs water will be observed to be trickling out of the bottom of the sack, the side of which—near the point of entry of the steam—is moreover saturated with water, whereas in normal working of an undamaged sack, the gradual horizontal descent of the steam level is only detectable from the outside by the temperature and a slight suggestion of dampness.

The correct amount of water for economical and optimum use is 5¾ gallons.

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It may here be mentioned that it is important that the steam hose from boiler to sack be drawn up as straight as possible to avoid condensation of the steam and water lying in the pipe.

(*b*) *The heating chamber*, or fire-box, is normally lined with asbestos sheeting, as also is the movable shield on the front of the box. It is obvious that if this asbestos is deficient or absent there will be considerable loss of heat.

(2) *The Paraffin Lamp.*—It is essential that this apparatus be correctly constructed and properly used. The following points may be considered worthy of note :—

(*a*) The paraffin oil should be strained through the funnel provided, and it should be ascertained that the fine wire-gauze strainer is intact.

(*b*) The jet is easily stopped up by a deposit of soot. Instead of carefully clearing it with the pricker provided, which can usually be done without putting out the flame, extra pressure is commonly employed to force the gas through and the clogging is merely increased.

It may be noted that prickers can easily be improvised from the fine pins used for mounting entomological specimens. They are held in position by means of a piece of tin (cut from a cigarette tin) of suitable shape as a handle, doubled over at the end, and pinched tightly to hold the pin at right angles.

(3) *Paraffin Supply Pipe.*—Worm tube. (*a*) It is particularly important that the whole paraffin delivery tube be heated by burning methylated spirit before paraffin is pumped in at all.

(*b*) Great differences are apparent in the working efficiency and heating power of these lamps, depending upon varying details in regard to the construction of the worm tube. This is frequently protected on the inside of the coils by an iron sleeve. This would appear to detract from the heating power of the lamp. Further, the angle at which the coil is set is of importance; if the angle is small (45°) the lamp is less effective than when the flame is directed more truly against the saddle-bottom of the boiler (about 60°).

(4) *Paraffin Reservoir.*—It should be ascertained that the butterfly nut on the filler inlet has an efficient washer to avoid loss of pressure.

(5) *Pressure.*—For effective use is about forty-five pounds, shown on an indicator.

(6) The lamp holds about 4¼ pints of paraffin and uses a trifle over three pints in the disinfection of one normal load of twenty-five blankets.

The various *sources of heat* employed with the Lelean Sack were as follows :—

(1) Paraffin lamps, various, as issued; (2) four-burner Primus stove; (3) wood fuel; (4) coal (wood being used for kindling the fire); (5) coke (wood being used for kindling the fire); (6) oil-and-water fuel.

The experiments were commenced in the spring when the temperature of the water was commonly about 46° F., and the air temperature about

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50° F., and were necessarily continued over a long period of time, during which water and air temperatures, as taken at the commencement of each experiment, gradually rose; it is therefore apparent that the conditions of the later experiments are slightly more favourable to quick times and success.

The following general results have been obtained with the various sources of heat:—

(1) *Paraffin Lamp.*—Providing that the lamp is worked faultlessly, and is itself in perfect condition, it is capable of producing steam from $5\frac{3}{4}$ gallons of water in the boiler, and dealing with a full load of twenty-five blankets without refilling. It requires for this purpose a trifle over three pints of paraffin (sixty-three ounces).

According to weather conditions (cold or wind) steam will be produced and be issuing freely at the end of fifteen to twenty minutes. The hose having been connected to the sack, steam will have passed through at the end of a further eighteen to thirty minutes—commonly twenty-three minutes.

The depth of water remaining in the boiler over the centre of the saddle-back, after dealing with one load, will be about 3 inches or 4 gallons (i.e., $1\frac{3}{4}$ to 2 gallons of water are required per load), and it will of course be necessary to replenish the boiler up to its original content of $5\frac{3}{4}$ gallons before proceeding with another load.

(2) *Four-Burner Primus Stove.*—It was found that unless the load of blankets is reduced, sufficient pressure of steam cannot be maintained to force its way through and issue below.

Using twenty blankets, disinfection was successfully carried out. An average time of thirty minutes was required to produce steam, and this appeared from the bottom of the sack after a further interval of forty minutes; it was, however, necessary to refill the lamp in the course of the experiment.

Roughly, 1 pint of paraffin is used per half-hour, and the total content, when full, is 52 ounces, say $2\frac{1}{2}$ pints.

It is clear that, if filled as full as possible, the lamp might just complete one cycle of disinfection, but it will then be completely empty; it will in fact be necessary, in order to keep it going properly, to fill it to a reasonable extent only and to refill it in the course of the disinfection.

Refilling and relighting the hot lamp can be done very quickly, and practically does not interfere with the course of the disinfection.

These experiments were carried out in order to ascertain whether the four-burner Primus stove, which is issued to general hospitals [3], casualty clearing stations [2], and is occasionally available in other medical units and establishments, is capable of being used as a substitute for the lamp usually issued with the Lelean Sack.

(3) *Wood Fuel.*—It is possible to disinfect a full load of twenty-five blankets by means of a wood fire.

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It was found to be markedly advantageous to raise the grid on four half-bricks in order to bring the whole fire more directly under the saddle of the boiler and thereby increase its heating powers. Wood was chopped into pieces some 9 inches by 2 inches by 2 inches, and the fire was originally kindled by means of paper. Once the fire was burning freely and the water had been raised to boiling point, it was noticed that steam issued freely and steadily.

There was found to be a very marked difference in various experiments in the total amount of wood required, as also in the time taken to raise steam.

The amount of wood used varied from a minimum of 28 pounds in one experiment up to 50 pounds in another, and the time taken to produce steam varied from 15 minutes to 40 minutes ; once, however, a really good wood fire had been got going, steam issued from the bottom of the sack at the end of an almost constant period of some 28 minutes from the time when the hose was connected up to it. These varying results are clearly due to the nature, quality and dryness of the wood used, but are also influenced to a considerable extent by the amount of wind and its direction.

If the apparatus is correctly placed, a good draught will appreciably decrease the time taken to produce steam, whilst the cooling effect of the wind on the Lelean Sack appeared to be very little, as shown by the remarkably small variations in the time taken for the steam to issue from the bottom of the sack ; it is, however, a *sine quâ non* that the sack be in good condition, thoroughly steam-proof and not in need of re-doping with the preparation previously referred to.

There is no doubt that the Lelean Sack can be easily and effectively worked by means of a supply of good-quality wood.

(4) *Coal.*—The fire has first to be kindled with paper and wood, some six pounds of the latter being essential in order to get the coal fire going properly.

With this fuel, as with wood, the results are greatly influenced by clever stoking with the production of a fierce red fire, and are much aided by a certain amount of forced draught produced by wind.

The grid was raised on four half-bricks, as was done in the case of wood.

If well managed, steam is produced in about thirty minutes and comes off in great volume, so that the water in the boiler tends to get rather low by the end of an experiment or disinfection. Steam will be found to be issuing from the bottom of the sack in twenty-eight to thirty minutes with the same constancy as in the case of wood. At the end of these experiments, both with wood fuel and coal, the fire was still burning fiercely, and further trials were carried out in order to determine the minimum quantities that could be used with success.

These were found to be 28 pounds of wood and 21 pounds of coal, but

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in the latter case 6 pounds of wood had also been used in order to start the fire.

It will be seen then that, as in the case of wood, disinfection can be efficiently carried out in the Lelean Sack by means of a coal fire.

The following disadvantages were, however, noted where the source of heat is an "open" fire:—

(*a*) The grid showed definite signs of burning through after only a small number of experiments in which the fuel (wood, coal and coke) was burnt directly upon it.

(*b*) A very heavy sooty or tarry deposit is noticeable after the use of coal (not so in the case of wood), and it is necessary to withdraw the boiler from the case and brush it off; this was easily done (*vide*, however, use of oil-and-water fuel).

It is clear that this must be done daily or even oftener, depending upon the amount of work done, as the flue leading to the chimney has portions which are very narrow.

(*c*) It will be found that, unless the fire is raked out at the end of the experiment or disinfection, it will go on burning more or less fiercely and will necessitate the addition of water to save the boiler from being burnt out.

(5) *Coke Fuel.*—The fire has first to be kindled with seven pounds of wood and some paper. The initial wood was inserted *en masse* and kindled; when red hot the coke was gradually added. It is best to put larger lumps (say three inches) on to the actual grid and in front to confine the fire; the remaining coke is best broken into two-inch pieces.

It should be noted that the successful production and maintenance of a bright red coke fire is a matter of some skill.

It was found possible to bring the usual experiment to a successful conclusion with seven pounds of wood for initial kindling and twenty pounds of coke, and have a large red fire remaining at the end.

Steam was raised in a minimum of thirty minutes and took fifty minutes to penetrate the sack; doubtless these times could be improved upon with more practice and skill in handling this difficult fuel. It can be said that the use of coke is a possibility with an initial kindling by means of wood, but it is difficult and the time required is likely to be excessive unless management is unusually skilful.

It is further apparent that in the use of wood, coal or coke—separately or mixed—the method of working will differ slightly if it is intended to disinfect more than one load.

In such case it will clearly be advantageous to make rather a large fire. This may take rather longer to get red hot all through and thus lengthen the time of production of steam, but will last longer and be easily kept up to fierce red heat; also it is obvious that, after the first load is completed, the average time for subsequent loads will tend to be reduced.

(6) *Oil-and-Water Fuel.*—It may be stated at once that with the Lelean

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apparatus as at present issued, this method of working was a complete failure. It was arranged to use "front feed" in order to avoid making additional holes at the back of the heating chamber. The mixture of oil and water was therefore conducted to the back of the baffled tray by means of angle iron covered with sheet iron to produce an enclosed V-shaped feed-pipe. The oil and water containers were raised to the requisite height on a small wall of bricks, and a splay mouth of bricks was arranged on either side of the front of the furnace. Steam was produced in thirty-five minutes (one and a half to twice the usual time required), and after passing into the sack for fifty minutes the water in the boiler was noted to be below safety level. The experiment was then discontinued without steam having issued from the bottom of the sack.

Using *oil-and-water fuel* and *front feed* the following points were noted :—

(*a*) Boiling and occasional firing of the oil and water takes place as it runs along the feed-pipe and before ever reaching the baffle tray; this results in a very irregular supply of fuel, which is usually either in excess or deficient.

(*b*) There is a great loss of heat by flames from the front of the (insufficiently) covered front.

(*c*) The baffle tray used being too long—the protruding portion had to be blocked with a wall of sand—at the point where it emerged from the furnace, it is obvious that the construction of a baffle tray of suitable size is essential to the use of oil-and-water fuel with this apparatus.

Such a tray was constructed by Ordnance and used in later experiments.

(*d*) The lower opening of the chimney being within one-third of an inch of the top of the boiler, no draught is produced and the narrow flue becomes nearly choked with a deposit of oily soot. As a result there is a tendency for the fire to go out unless an abnormally high proportion of oil is used, thus increasing the deposit.

The complete absence of an adequate draught seems to preclude the use of oil-and-water fuel with this apparatus without considerable modification, besides necessitating the issue and carriage of a special baffled-tray of correct size.

In later experiments a close-fitting shield of cresol drum iron was fitted to the front to continue the shield of the fire-box down to ground level, the fuel-feeding trough passing right through it. This also resulted in complete failure.

For the reasons already referred to there was very irregular heating with occasional violent priming and resultant wetting of the contents of the sack; thirty minutes after attachment of the hose steam had only succeeding in penetrating some ten inches through the contents. More delicately adjusted taps on the oil and water containers did not improve matters. It was again shown that this method fails, and must continue to fail without considerable modification of the present apparatus, owing to inability of the smoke to get away and absence of draught.

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Smoke emerges everywhere except through the chimney, owing to the insufficiency of the clearance between the top of the boiler and the lower opening of the chimney, and doubtless this defect also affects adversely the use of any method of heating other than the paraffin lamp.

Even when the oil-and-water mixture was burning satisfactorily for brief periods there was considerable loss of heat, owing to flames getting out behind through the draught holes provided instead of playing up around the back of the boiler.

Clearly without considerable modification of the existing apparatus the use of oil-and-water fuel is definitely impossible.

The following tabulated statements summarize the results obtained and times required for the working of the Lelean Sack:—

TABLE "A." WITH PARAFFIN LAMP AS ISSUED.

Personnel 2 *men.* *Load* 25 *blankets.*

Unpacking and assembling	Loading	Working	Unloading	Total
Both men unpacking and assembling, 4 minutes	2 men loading 25 blankets, 6 minutes	Required to produce steam, 16 minutes	Unpacking, drying by shaking and folding, 7 minutes	
Job A Filling boiler with 5¾ gallons of water with jugs and funnel, 4 minutes [1]	This can be done whilst steam is being raised	To pass through sack and issue freely below, 22 minutes		
Job B Filling up, preparing and heating paraffin lamp with methylated spirit, 4 minutes A and B work concurrently		Additional time allowed, 5 minutes		
8	..	43	7	58

[1] Capable of reduction if convenient method (tap and hose pipe) is available.

SECOND LOAD.

Reconditioning	Loading	Working	Unloading	Total
Refilling stove with paraffin and refilling boiler up to 5¾ gallons	2 men loading 25 blankets	To produce steam (proceeding during loading), 0 minutes	Unpacking, drying by shaking and folding, 6½, say 7 minutes	
2 minutes (concurrently)		To pass through, 22 minutes		
N.B.—To be done before unloading		Additional time allowed, 5 minutes		
2	6	27	7	42

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(2) The Harold-Thompson Drum Disinfector.

This apparatus has been designed at the Army School of Hygiene as a substitute for the cumbersome Thresh (Portable) Disinfector; it embodies ideas and designs by Major C. Harold, O.B.E., Major T. O. Thompson, Lieutenant-Colonel W. Browne, O.B.E., and other officers.

The Thresh (Portable) Disinfector is capable of dealing with only thirty blankets per hour, and from one to one and a half hours may be required to get up steam if the apparatus is cold.

Steam enters from below, and the load cannot be increased beyond the above figure without the danger of disinfection being incomplete.

In the Drum Disinfector the aim has been to decrease weight and size, whilst increasing the capacity of the apparatus.

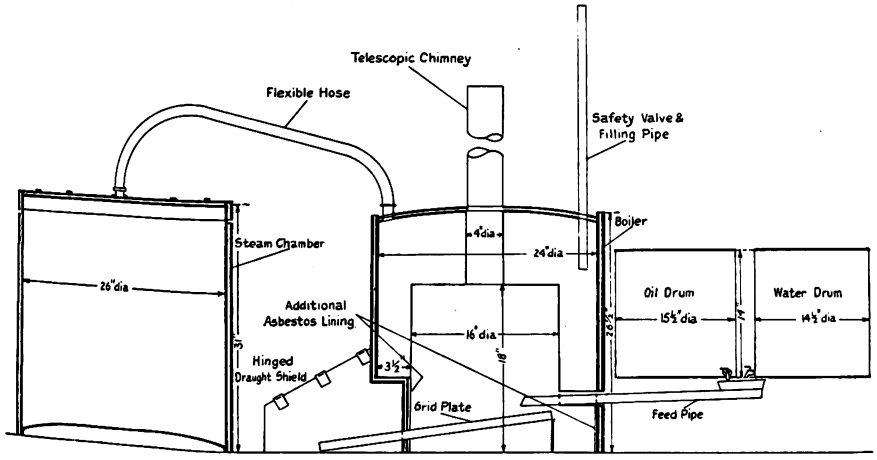


Fig. 1.—Drum Disinfector. General arrangement in action.

Description.—The disinfector consists of an oil-and-water heated boiler from which steam is led by means of a flexible rubber hose to two large disinfecting drums of slightly dissimilar size, so that the smaller can just be packed into the larger.

The smaller drum itself has been designed to contain the whole of the rest of the apparatus when packed.

The boiler and drums have been constructed with the special objects of being tough, light, and capable of retaining as much heat as possible, and are made of a double layer of duralumin lagged with asbestos sheeting between them. The total weight of the apparatus is some 376 pounds (compared with over 2 tons for the Portable Thresh).

The Fuel Supply.—The oil and water are fed from two large containers (each 14½ inches in height and respectively 14½ inches and 15½ inches in diameter). These are placed on collapsible iron stands, and, from taps

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which can be adjusted with some precision, the contents are allowed to drip into a small open trough, say 5½ inches long (the water on to the oil), continuing as a feed-pipe, which screws into a threaded hole in the rear of the boiler wall.

The mixture of oil and water running through drops on to a slightly-inclined fire plate; this is constructed of sheet iron and fitted with shallow alternating baffles to direct the burning mixture from side to side as it runs slowly down.

In connection with certain experiments carried out under the direction of Lieutenant-Colonel W. Browne, then Officer Commanding, Army School of Hygiene, it was stated that the fuel used should be crude oil sp. gr. 0·85, F.P. not less than 150° F.

Whilst this represents the characteristics of the crude oil usually supplied for the purpose, it would appear from certain experiments conducted by the writer that it is also possible to use other oils of less definite specification. It was found that used motor-engine oil could be employed with success, the only difference being an increase of some five minutes in the time of getting up steam, after which there was no loss of efficiency in working.

Owing to the well-known apparent thinning of used motor oil it is necessary slightly to decrease the slope of the baffled tray by raising its anterior end; if this is done the mixture can be completely burnt, hardly any being wasted by dropping out in front.

Practically identical results were obtained with used motor oil which had stood for about six months, and freshly-discarded samples. It may be mentioned that in certain commands used motor oil is collected and is therefore available.

Manipulation of the Fire.—The mixture of oil and water cannot be directly ignited; it is necessary to soak a fair-sized piece of waste material thoroughly in oil (preferably with a little paraffin) and ignite it after laying it right across the baffled fire-plate. Once this is thoroughly hot, the mixture of oil and water falling on to it will be ignited and burn fiercely with much sizzling and spluttering.

On this account a collapsible sheet-iron guard is placed in front of the furnace.

Adjustment of Mixture.—The oil and water receptacles are so arranged and adjusted that drops of water fall with moderate rapidity into the little trough which continues as feed-pipe, falling on to a thin stream of oil as it runs along.

The relative quantities require to be so adjusted that smoke comes off steadily and is of a whitish colour. Too much oil is indicated by volumes of black smoke; too much water extinguishes the fire.

The Boiler.—This consists of a circular boiler riveted into a shell of duralumin constructed in the same way as the drums of double duralumin with asbestos lining between them. A sector of the lower part of the shell

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is cut away to allow the fire-plate to be inserted and provide fire-space under the boiler and air draught.

The boiler has a capacity of over seventeen gallons, but should be worked with not more than sixteen gallons.

A vertical hole some twelve inches long and four inches diameter passes right through its centre and indicates the depth of the central portion. It carries off flame and smoke, and a collapsible (twenty-four inch) chimney can be attached to a socket in the top.

The outer portions of this circular or ring-shaped boiler are carried down to about eight inches from the ground, except at the front, to form a shallow three-inch water jacket just inside the shell. This gives very intimate contact between the boiler and the source of heat, whilst further conservation of heat is secured by asbestos lagging of the aluminium shell below this right down to ground level.

The top of the boiler is constructed with :—

(1) The central vertical hole to carry off flame, as above described.

(2) Socket for collapsible chimney.

(3) A two-inch brass union to take one end of the flexible steam-pipe.

(4) A one-inch bore vertical pipe screwed into a threaded hole which dips below water level to a distance of some four inches down from the top and is open above.

This acts as a water gauge by allowing steam to escape when the level of water falls below the end of the tube.

It will also show any excessive heating by violent priming.

The Steam Supply.—An armoured flexible rubber hose of 1½ inches diameter carries steam from the boiler to the disinfecting drums, being attached at each end by brass unions.

The Disinfecting Drums.—Each consists, as already stated, of a double wall of duralumin lagged with asbestos in between. The cover, of similar construction, is secured by four bayonet-type catches. Fitted in the centre of the cover is the brass union to connect with the steam-pipe previously referred to. Packing of thick felt washers is used in the flange of the cover to prevent escape of steam.

Holes are drilled in the bottom of the drums to allow the steam to escape after having permeated the contained clothing

The drums are respectively 34½ inches and 31½ inches high with the covers on, and their diameters are respectively 27½ inches and 26 inches.

Experiments were undertaken in order to ascertain or corroborate times and details of working this apparatus.

The results were as follows :—

Personnel required, two men.

Time of Assembly.—This takes approximately eight minutes. This does not include the time required to fill the boiler with sixteen gallons of water, which was found to be the optimum amount to avoid unnecessary waste of water by priming. This can be done in about six minutes, but

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takes less time if a convenient tap with a hose-pipe is available. During this time the second man can be lighting the fuel mixture. Total time of preparation and assembly, fourteen minutes.

Loading of the Drums.—Time required for packing the larger drum with twenty-five blankets, five minutes. Time required for packing the smaller drum with twenty blankets, four minutes. The larger drum can of course be packed whilst steam is being raised and the times taken should not be added to the total. Similarly there is ample time to pack the smaller drum during the disinfection of the contents of the larger, and this time, four minutes, should also be excluded from the totals. After steam is being evolved freely and the hose has been attached, the time taken to pass through the larger drum was found to be nineteen to twenty minutes, and through the smaller fifteen to sixteen minutes. An additional period of five minutes was given as usual and was found by the ordinary tests to be adequate.

Unpacking.—After disconnecting the hose and removing the lid, the times required to unpack and remove the steam-filled blankets, shake out and fold each one, was found to be six minutes for the larger drum and a little over four minutes for the smaller.

Results may be tabulated thus:—

First load			Reconditioning	Second load	
Preparation	Disinfection	Unpacking		Disinfection	Unpacking
Unpacking and assembling, 8 minutes	To raise steam, 33 minutes	Removing, shaking out and folding 25 blankets, 6 minutes [1]	Refilling boiler to original level, 1 minute	To pass through 20 blankets, 16 minutes	Disconnecting steam-hose and removing lid, 1 minute
Filling boiler with water, 6 minutes	To pass through 25 blankets, 20 minutes		To reproduce steam, 5 minutes	Additional time allowed, 5 minutes	As for first load, 20 blankets, 4 minutes
	Additional time allowed, 5 minutes				
	Disconnecting steam-pipe and removing lid, 1 minute				
14	59	6 [1]	6	21	(1) 4 [1]
Totals: First load, 79 minutes				Second load, 32 minutes	

[1] Only included if no subsequent loads are to be done.

Thus the first load of 25 blankets requires a total of some 73/79 minutes, and subsequent loads can be dealt with as follows:—

(1) Smaller drum, 20 blankets, 32 minutes
(2) Larger ,, 25 ,, 38 ,,
} If no further loads are to be done.

Including disconnection, reconditioning, disinfection and unpacking.

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It is further clear that if other loads are to follow, the time of unpacking can be subtracted in each case, as this can be done after the apparatus has been reconditioned and reconnected to the next packed drum.

Results may be tabulated somewhat differently thus :—

Time of assembly and preparation	First load	Second load (even numbers)	Third load (odd numbers)
Unpacking and assembling, 14 minutes	Packing 5 (ready)	Packing 4 (ready)	Packing 5 (ready)
	Steam passing, 19 minutes	*Reconditioning*— Refill, 1 minute	*Reconditioning*— Refill, 1 minute
Getting up steam, 33 minutes	Additional, 5 minutes	Steam up, 5 minutes	Steam up, 5 minutes
	Unpacking, 6 minutes	Steam passing, 16 minutes	Steam passing, 19 minutes
		Additional, 5 minutes	Additional, 5 minutes
		Unpacking, 4 minutes	Unpacking, 6 minutes
47	24-30 minutes	27-31 minutes	30-36 minutes.

Or roughly half an hour per load after the necessary three-quarters of an hour for preparation; thus the apparatus can be described as doing forty-five blankets per hour after steam is up.

In six hours' continuous running, carried out under the direction of Lieutenant-Colonel W. Browne, 225 blankets were disinfected. This is at the rate of about thirty-eight per hour for the whole period or, subtracting the initial forty-seven minutes required to unpack, assemble, and get up steam, at the rate of forty-six blankets per hour.

Comparing this with the results obtained by the writer, they are found to be almost identical, Colonel Browne's figures showing a gain of thirteen minutes in six hours. It is not, however, clear how long the steam was allowed to continue to pass in each instance after its initial appearance from the bottom of the drum. Oil consumption is about $1\frac{1}{4}$ gallons per hour. Water consumption in boiler one gallon per half hour.

Method of Transportation.—Weighing, as it does, some 376 pounds, there is no difficulty in loading and securing the apparatus on a motor trailer.

The size in fact enables a battery of three to be packed in the same vehicle and would provide apparatus for a disinfecting station of some size.

Although there is a great gain in weight in comparison with the cumbersome Portable Thresh, it must be remembered that the drum disinfector will have to be man-handled.

Unless this loading process is thought out and standardized it is almost certain to result in denting of the drums and considerable difficulty in unpacking (although this has not occurred to date).

The following suggestions are made towards the solution of this little difficulty :—

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(1) A stout leather or rope surcingle with four grips should be placed horizontally around the body of the drum, prevented from slipping up by means of two other vertical bands or ropes crossing at right angles underneath the drum.

This is an old suggestion of which a rough drawing was found. It is

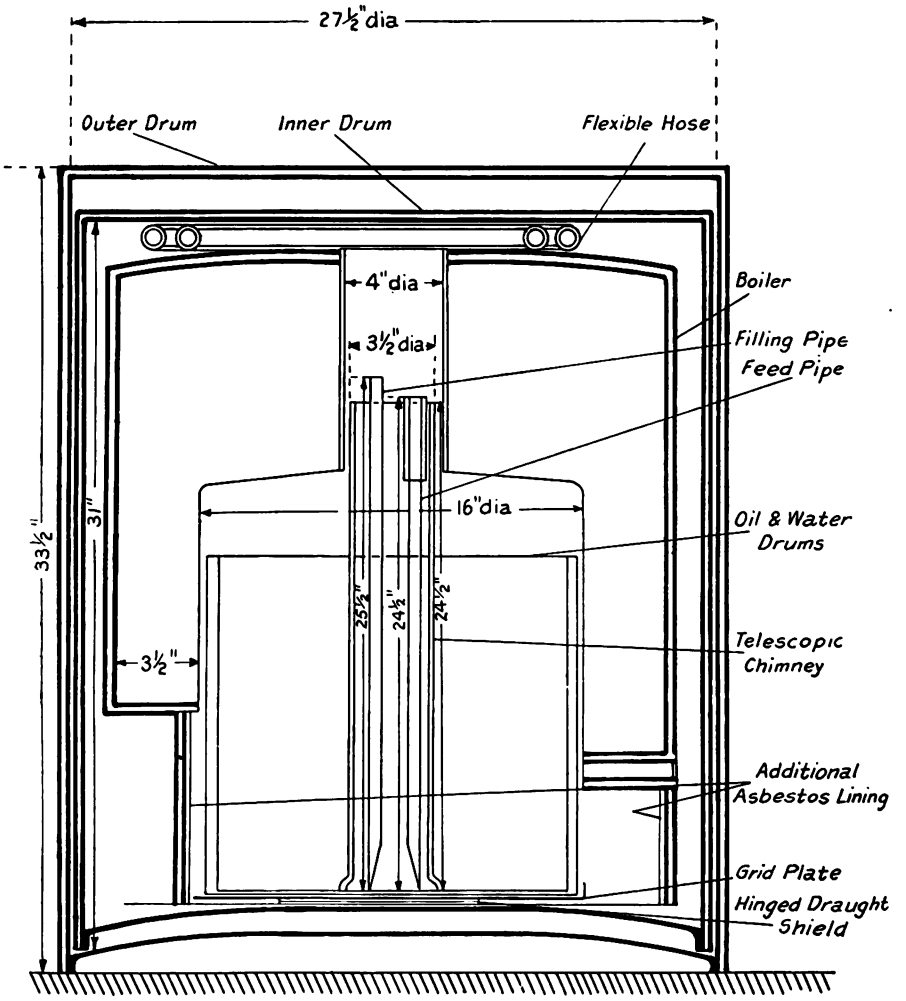


FIG. 2.—Drum Disinfector. Sketch showing method of packing and attachment to trailer. Section showing disinfector packed ready for transport.

considered to be of limited utility only, as the drum would not normally be lifted in this manner by two men.

(2) A strong iron and wood slide, such as is used for rolling beer barrels down from brewers' drays.

In order to improve this process it is suggested that the slides be grooved to take two bands of cane, flexible metal or other suitable material,

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permanently fixed horizontally round the drum, as seen in the case of fibre and cane cabin trunks.

It is, however, pointed out that beer barrels are usually allowed to slide and are not rolled down; it is claimed that by this method they are under better control. It may therefore be considered advantageous to omit the circular hoops altogether and lower by sliding only.

(3) The Serbian Barrel.

Improvised Disinfector or Disinfestor (Downward Displacement).

The apparatus consists essentially of an ordinary thirty-six gallon barrel embedded in earth to within a short distance of the top, and fed by steam from an improvised boiler, which enters the side of the barrel about three inches from the top.

It is convenient to arrange such Serbian barrels along the side of a shallow trench about eighteen inches deep, in the wall of which the boiler and furnace are erected.

The steam, having traversed the barrel and its contents, emerges by holes in the bottom and is led off into the trench by means of a one-inch pipe.

It can be stated at once that some trouble and attention to detail are necessary in order to secure satisfactory working with this apparatus.

A number of attempts were completely unsuccessful, and the whole apparatus was reconstructed more than once.

Originally made with two five-gallon cresol drums as boilers, placed with their long axes at right angles to the depth of the furnace (i.e., parallel with the trench), it was found that steam could be produced quickly, but that only one drum was producing it. Doubtless this could have been avoided by judicious stoking of a very long and fierce fire, but the disadvantage of two boilers is thereby emphasized.

In view of the fact that a five-gallon drum can only hold about 3½ gallons of water, the second drum had to be built to provide a sufficient head of steam. The apparatus was re-erected with a ten-gallon drum in lieu of the above, placed over and with its long axis in the direction of the furnace, i.e., at right angles to the trench.

To obtain success good stoking and an ample supply of fuel are essential, a fiercely burning fire being maintained along as much as possible of the length of the drum.

Steam was produced in this apparatus in about twenty-seven minutes, and a sufficient head of steam maintained to obtain penetration through the whole contents of the barrel and emergence below in about fifty minutes.

It was, however, found necessary to reduce the load to twenty-two blankets before success was obtained.

The following points in construction are worthy of note:—

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(1) *The Barrel.*—Should be a good one, reasonably water-tight and steam-proof. If it is old and the wood has dried and shrunk, there will be much difficulty from leakage of steam and changes of shape. As regards the latter, definite bulging may take place when filled with blankets, thereby altering the diameter at the ends and upsetting the fit of the lid.

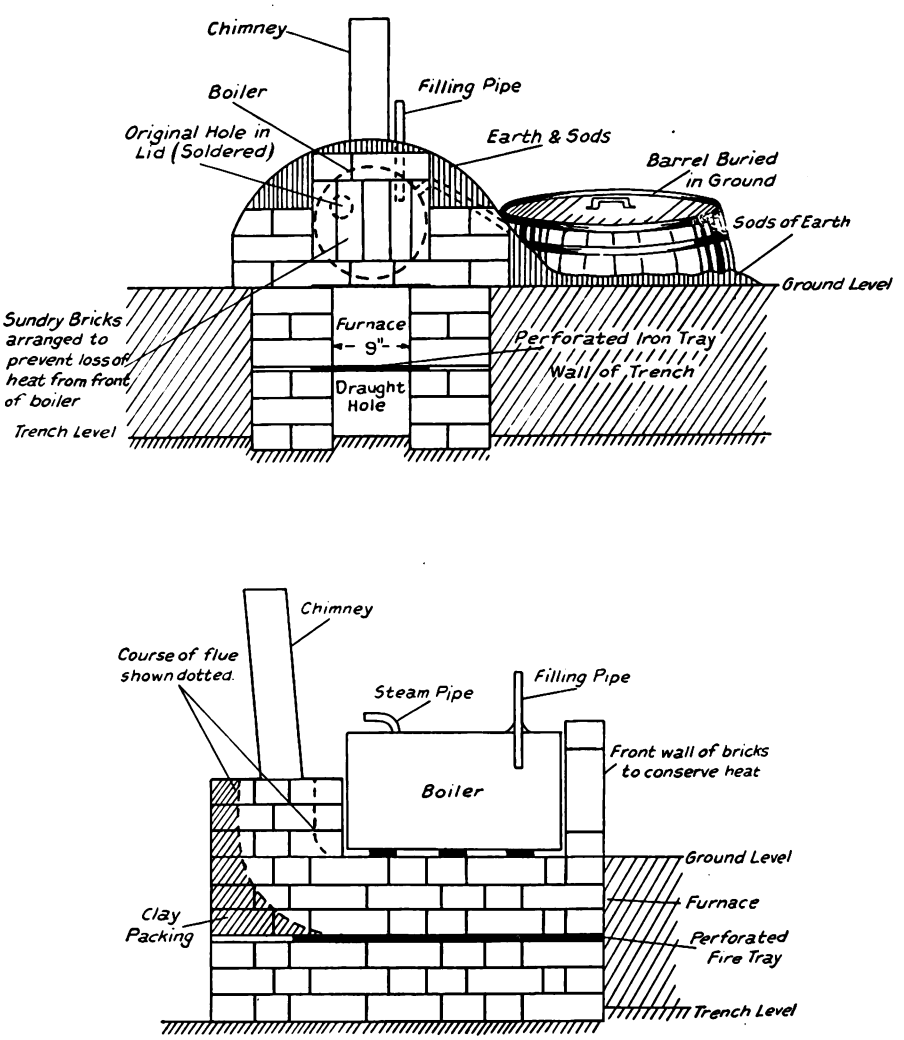


FIG. 3.—Serbian Barrel Disinfector. *Front elevation:* Steam-pipe leading from boiler, entering side nearest furnace some 3 inches from top of barrel. *Longitudinal section:* Posterior angle of flue packed with puddled clay to produce curved path.

The barrel should be supported on bricks in order to produce a small space under the perforations in the bottom.

Efforts must now be made to "wall off" the space effectively, in order to prevent the loss of steam that otherwise occurs by percolation into the

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surrounding earth. This is best done by means of puddled clay around the supporting "box" of bricks; its only exit-hole should be the pipe which leads the steam away. It is obvious that failure in regard to this detail will be responsible for a considerable increase in the apparent time required for the steam to penetrate the barrel, as evidenced by its emergence from the exit-pipe in the trench.

Further and for somewhat similar reasons it is necessary to separate the barrel and its support very thoroughly from the boiler and furnace; this is also accomplished by means of a wall of brick and puddled clay.

Actually the wall in question is one of those supporting the boiler, and is of course the one between it and the barrel.

If this packing off with puddled clay is badly done or omitted, smoke will find its way through the wall, percolate through the packing of earth surrounding the barrel and emerge from the exit-pipe in the trench with or in lieu of steam, thus precluding any possibility of gauging the end of the disinfection correctly.

The Barrel Lid.—This must be made to fit as securely as possible, and on this depends the success or failure of the apparatus.

If the lid fits badly sufficient pressure of steam can obviously not be maintained to penetrate the contents of the barrel. This can be effected as follows:—

(1) The top of the barrel should be well padded with tightly-stretched strips of blanket.

(2) The lid must be prepared in either of the following ways: (*a*) A flange is made on the under surface to fit over the edge of the barrel, or (*b*) the edge of the barrel and the lid are carefully bevelled and padded.

If this method is used and the lid lies snug in the bed provided for it, the joint can be cemented all round by means of puddled clay.

The furnace is made by digging a hole of suitable depth and width into the walls of the trench, depending upon the size of the boiler. This hole is then lined with bricks. It is necessary to insert a fire-tray, e.g., of corrugated iron beaten out flat, above the first two courses—at such height above the ground that the draught-hole under it may be about six inches in height. It is essential that the fire-plate be plentifully pierced with air-holes, or failure will result.

For this reason close-laid fire-bars, if available, tend to be more efficient. Above this the wall is continued for a further two or three courses, as may be considered suitable, and the boiler is supported so that it will close the furnace above, at the same time allowing some considerable play of flames around its sides.

The Flue.—Behind the boiler the furnace continues back into the *flue* leading to the chimney. This must be ample in depth and may well consist of a course of two bricks (eighteen inches) on either side separated by the length of one brick (i.e., nine inches) laid transversely to close the flue behind. This quadrangular space is then built up to about the heigh t

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TABULAR SUMMA

Type of disinfector	Method of heating	Fuel		Boiler		First Load						Total time required for First Load
		Amounts		Amounts of water		Unpacking and assembling	Loading		Working			Unloading
		To fill lamp	Used per load	To fill boiler	Used per load		No. of blankets	Time required	To produce steam	To pass through	Additl. time allowed	Time required
Lelean Portable (Sack)	Paraffin lamp.	Pints $4\frac{1}{4}$	Pints 3	Gals. $5\frac{3}{4}$	Gals. $1\frac{3}{4}$-2	8 min.	25	Min. 6(i)	Min. 16	Min. 22	Min. 5	7 min.	58
	4-burner Primus	$2\frac{1}{2}$	$2\frac{1}{4}$	,,	,,	,,	20	5(i)	30	40	5	6 ,,	89
Personnel—2 men	Wood	..	28 (i)	,,	,,	,,	25	6(ii)	15(i)	28	5	7 ,,	63
	Coal	..	lb. Wood 6 Coal 21	,,	,,	,,	25	6(i)	30	28	5	7 ,,	78
	Coke	..	lb. Wood 7 Coke 20	,,	,,	,,	25	6(i)	33	50	5	7 ,,	103
Drum Disinfector	Oil and Water	Oil 2.3 gals.	$1\frac{1}{4}$ gals. per hour	16	2	14 ,,	25	5(i)	33	20	5	6 ,,	79(ii)
Serbian Barrel (D.P.)	Wood	..	40 lb. per load	10	2	*Nil*	22	5(i)	27	50	5	6 ,.	88
	Coal and Wood	..	28 lb. 7 lb.	10	2	*Nil*	22	5(i)	27	50	5	6 ,,	88

of the top of the boiler, closed above by means of some metal sheeting with a hole cut in it, and a chimney of cresol drum metal fitted. It is considered advantageous to diminish the rectangular turn of the furnace to flue by filling in the posterior angle with puddled clay, thus producing a curved path for the flames and smoke.

The heating power of the furnace is entirely dependent on the drawing

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RESULTS.

(ii) reconditioning apparatus			Second Load					Total time required for Second Load	Notes
			Loading		Working		Unloading		
ll p	To refill boiler	To produce steam	No. of blankets	Time required	To pass through	Extra time allowed	Time required		
n.	Min. 2(iii)	Min. 5(iv)	25	Min. 6	Min. 22	Min. 5	7 min.	42 min.	(i) Can be done whilst steam is being raised (ii) To be completed before unloading of 2nd load (iii) Concurrently with reconditioning lamp (iv) Steam is being produced during 1st unloading and 2nd loading
	2(iii)	10(iv)	20	5	40	5	6 ,,	58 ,,	Notes (i) (ii) (iii) (iv) as above
	2	5(iii)	25	6	28	5	7 ,,	48 ,,	(i) or considerably more depending on quality (ii) as (i) above (iii) as (iv) above
	2	5(ii)	25	6	28	5	7 ,,	48 ,,	(i) done whilst steam is being raised (ii) as (iv) above
	2	5(ii)	25	6	50	5	7 ,,	70 ,,	(i) as (i) above (ii) as for paraffin lamp
	1	5	20	4(iv)	16	5	4 ,,	32(iii) ,,	(i) as (i) above (ii) includes disconnecting steam-pipe 1 min. extra and removing lid of drum 1 min. (iii) as in (ii) (iv) ready packed
	1	5(ii)	22	5	50	5	6 ,,	67 ,,	(i) as (i) above (ii) being produced during 1st unloading and 2nd unloading
	1	5(ii)	22	5	50	5	6 ,,	67 ,,	(i) as one above (ii) as (ii) above

power of this flue and chimney, and, although it would seem a simple enough matter to improvise it, many errors can be made before success is achieved.

The Boiler.—It will first be necessary to close the ordinary hole in the end of the drum to enable it to be used in the horizontal position ; a steam-pipe and water-filling pipe must also be fitted.

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How this is done will naturally depend on the means available ; a workshop is practically essential for making the water-tight joint required to close the hole in the lid, but improvisation will suffice, if necessary, for junctions of the two pipes.

The feed-pipe for water can have its end dipping below the intended level of the water in the boiler, to act as a water-level gauge when working by permitting steam to emerge when the lower end ceases to dip.

A funnel to pour in water is advisable.

A measuring stick should be prepared having water levels in gallons marked off on it. If made of wood it must be varnished to show the line of demarcation. It will be difficult to work safely and efficiently without it.

Results of Working.—The apparatus has been worked with wood only, and with wood and coal ; the results may be summarized as follows :—

Load.—Not more than twenty-two blankets. Time required for packing, five minutes.

Fuel Requirements.—(1) Wood only, 40 pounds ; (2) coal, 28 pounds with 7 pounds kindling wood.

Steam generated in twenty-seven to thirty-five minutes, according to quality of fuel, stoking and amount of draught or wind.

The time taken to generate steam can only be observed by not packing the two uppermost blankets until steam is seen to be entering the barrel. They are then rammed in and the lid put on, sealed as described, and well weighted.

Time of Passing through, Fifty Minutes.—It is considered that this time is capable of considerable improvement and that it was increased by : (1) The use of a dry and faulty barrel ; (2) escape of steam underneath it.

If these defects are avoided there would seem to be no reason why steam should not penetrate and issue below in thirty to thirty-five minutes or less from the time that it is generated.

Second Load.—If more than one load is to be done a larger boiler is particularly advantageous, and if necessary water for refilling should be added before unloading. This temporarily stops the flow of steam and facilitates unpacking. In view of the large fire which should be remaining if stoking has been properly carried out, steam will properly be "up" again by the time that unpacking and repacking have been completed, so that no time is lost by reconditioning.

Unpacking.—As above indicated, unless some means are taken to prevent steam from continuing to enter the barrel, unpacking is likely to be an uncomfortably warm process which may take some seven to nine minutes.

Steam can be shut off by plugging the hole through which steam enters the barrel by means of a wooden bung.

As the water level has been reduced, or if other loads are to be done, cold water has been added to the boiler before unpacking is commenced, there will be little danger from rising steam pressure. In such circum-

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stances unpacking, shaking out and folding of twenty-five blankets can be completed in six minutes.

It may be objected that the somewhat complicated structure eventually evolved hardly comes under the heading of improvisation; such criticism would be considered well justified.

The account is, however, a record of difficulties that may be met with in a loose sandy soil and errors that may be made in erecting such an apparatus.

Under more favourable circumstances, e.g., a stiff building clay soil, it is quite likely that brickwork could be entirely dispensed with, and that success could easily be attained by merely sinking a shaft vertically into the ground at an appropriate distance from the side of the trench, to act as flue for a horizontal furnace hole dug in at right angles to meet it.

With the barrel buried in the soil at such a distance as to leave a sufficiently thick wall of undisturbed earth, it is probable that an efficient and simple apparatus could be improvised which would act as well as that described.

The writer's acknowledgments and thanks are due to Lieutenant-Colonel G. S. Wallace, O.B.E., Commanding the Army School of Hygiene, to Private R. Donald, Private R. Steward, Private E. Brennen, and especially to Sergeant C. A. Milner for their helpful co-operation in these experiments; also to Private J. J. Cullen, who has elaborated the sketches which accompany the paper.

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DYSENTERY PROPHYLAXIS BY ORAL BILIVACCIN AT POONA AND SECUNDERABAD.[1]

By Major W. WALKER, M.C.,
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AND
Captain R. C. WATS,
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The exhaustive investigations by Major Manifold [1 and 2] into the prevalent types of dysentery encountered in Poona revealed the fact that the great majority were bacillary in origin. He further demonstrated that *B. flexner* was the most frequent infecting organism encountered.

Funds having been obtained from the Indian Research Fund Association, the task of preparing an efficient prophylactic Flexner vaccine was undertaken by the senior writer. Two strains of *B. flexner*, previously isolated by Major Manifold, were used for this purpose on account of their high antigenic properties. A vaccine containing a 1,000 million of each strain per cubic centimetre was prepared and preliminary animal tests having proved satisfactory as regards the production of agglutinins against the five standard strains of *B. flexner*, it was decided to test the vaccine on the laboratory staff. A serological examination of each individual, before the administration of the vaccine revealed the presence of agglutinins against *B. flexner* V, W, X, Z, and Y in all cases. The vaccine was administered in two doses, first dose ½ cubic centimetre followed by 1 cubic centimetre after an interval of ten days. Serological tests were carried out on each individual at frequent intervals, and it was found that the existing agglutinins rapidly disappeared in all cases. Further, two individuals developed acute bacillary dysentery within twenty-one days of the second dose of the vaccine. It was decided not to proceed further with human tests until more exhaustive animal tests could be carried out.

Just when matters in this line of investigation had come to a standstill, a liberal supply of oral bilivaccin was put at our disposal by the Director of Medical Services in India with the request that its efficacy be tested as a prophylactic against bacillary dysentery amongst the troops in the district. This definitely determined our future line of investigation in local dysentery prophylaxis. The bilivaccin was tried out in Poona and Secunderabad and the results are recorded herewith.

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[1] This research was financed by the Indian Research Fund Association. Reprinted by kind permission from the *Indian Journal of Medical Research*, vol. xvii, No. 1, July, 1929.

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Preliminary Notes.

(1) It was decided to limit this investigation to British troops only, the arrangement being to protect a certain number of men in a few selected units, the unprotected, living under identical conditions, would thus act as controls. Special dysentery case sheets were distributed to the hospitals concerned for recording the clinical signs and symptoms of all cases of dysentery treated during the period of this investigation. The laboratory technique employed was that described by Major Manifold [1 and 2] in his Poona investigations.

(2) The form of the preparation.—The bilivaccin is prepared by the Biothérapie Company, Paris, according to the researches of Professor Besredka. It is presented in the form of dark brown tablets packed in small glass containers, three tablets per container. Three tablets represent the full prophylactic dose for an adult. Full directions are issued with each package. The following extracts are quoted :—

> "Take on empty stomach one tablet of vaccine on three successive mornings. Food can be taken one hour after the ingestion of the vaccine.
>
> "After the entire dose has been taken (three vaccine tablets in three days), complete immunity is secured.
>
> "The immunity acquired lasts for one year. In case of epidemics, it is advisable to repeat the vaccination in a few months.
>
> "No special diet is necessary."

(3) The distribution of the vaccine.—It was decided to protect one entire infantry unit and a portion of another at Poona and 300 troops at Secunderabad.

The final distribution of the vaccine was as follows :—

1st Bn. The Cheshire Regiment	856 doses.
2nd Bn. The Royal Irish Rifles	250 ,,
British Troops, Secunderabad	294 ,,

(4) The method of administering the vaccine.—The selected troops were paraded by companies, on three successive mornings, soon after *réveillé*, without having partaken of the usual "gun-fire" cup of tea. The men were arranged in line, three deep. The front man of each row was handed a container of three tablets and, having helped himself to one, passed the remaining ones to the men behind him. No food was taken before one hour had elapsed.

(5) The immediate effects.—The great majority experienced no after-effects on swallowing the tablets. A few complained of slight abdominal discomfort. No case developed dysentery during or immediately after the administration of the vaccine.

The findings at Poona and Secunderabad will be dealt with separately.

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The Poona Investigations.

The vaccine was distributed to the troops during the third week of June, just prior to the expected "dysentery season." The material for this investigation was collected during the period July 1 to October 31, 1927. During the period forty-three cases of dysentery occurred amongst the British troops at Poona. Of these 36 or 83·7 per cent were bacillary in origin; 4 or 9·3 per cent were protozoal in origin; 3 or 7·0 per cent were unclassified.

The thirty-six cases of definite bacillary dysentery will first be considered in this report.

In twenty-four cases (66·7 per cent) the infecting organism was isolated, in the remaining twelve cases the typical bacillary exudate was demonstrated microscopically.

The distribution of these amongst the protected and the unprotected was as follows:—

	Shiga	Flexner	Bacillary exudate	Total
Protected	2	11	9	22
Unprotected	3	8	3	14
Totals	5	19	12	36

The Incidence of Cases in the Various Units, Poona.

	Strength of units	Number of cases	Ratio per 1,000
1st Cheshires.			
Protected	856	16	18·69
Unprotected	36	1	27·78
Total Regiment	892	17	19·06
2nd Ulsters.			
Protected	250	6	24·00
Unprotected	552	7	12·68
Total Regiment	802	13	16·21
Remaining British troops.			
Protected	Nil.	—	—
Unprotected	1,016	6	5·90
Total British troops, Poona.			
Protected	1,106	22	19·89
Unprotected	1,604	14	8·73
Total numbers British troops, Poona	2,710	36	13·21

Add to these figures the unclassified cases (exudate indefinite but suggestive of bacillary dysentery).

Total British troops, Poona.			
Protected	1,106	24	20·79
Unprotected	1,604	15	9·35
Total numbers British troops, Poona	2,710	39	14·39

Clinical Aspects of the Disease, Poona.

The first set of figures refers to cases of definite bacillary dysentery, those within brackets refer to definite plus unclassified dysenteries.

Duration of symptoms in days	Protected cases	Unprotected cases
Abdominal pain	1·29 (1·27)	1·50 (1·46)
Persistence of blood and mucus ..	2·14 (2·04)	1·71 (1·67)
Persistence of mucus only	3·91 (3·75)	2·71 (2·80)
Duration of fever	1·00 (0·96)	1·57 (1·46)
Highest temperature recorded ..	101° F.	104° F.

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The Secunderabad Investigations.

The material for this investigation was collected during the period July 1 to December 31, 1927. During this period fifty-seven cases of dysentery occurred amongst the British troops stationed at Secunderabad. These cases were classified as follows: 44 or 77·0 per cent were bacillary in origin; 2 or 3·5 per cent were protozoal in origin; 11 or 19·5 per cent were unclassified.

The report will first deal with the definite cases of bacillary dysentery.

The infecting organism was isolated in 26 (59·1 per cent) of the cases, the remainder showed the typical bacillary exudate. The distribution was as follows:—

	Shiga	Flexner	Bacillary exudate	Total
Protected	1	2	3	6
Unprotected	7	16	15	38
Totals	8	18	18	44

The Incidence of Cases in the Various Units, Secunderabad.

	Strength of units	Number of cases	Ratio per 1,000
1st Loyals.			
Protected	148	4	27·02
Unprotected	598	11	18·39
Total Regiment	746	15	20·10
1st Gordons.			
Protected	117	2	17·09
Unprotected	600	14	23·33
Total Regiment	717	16	22·31
Remaining British troops.			
Protected	29	Nil.	—
Unprotected	878	13	14·78
Total remaining British troops	907	13	14·33
Total British troops, Secunderabad.			
Protected	294	6	20·41
Unprotected	2,076	38	18·30
Total Number British troops, Secunderabad	2,370	44	18·50

Add to these figures the unclassified cases—their distribution was as follows: Among protected, 1; unprotected, 10.

Total British troops, Secunderabad.			
Protected	294	7	23·80
Unprotected	2,076	48	23·12
Total Number British troops, Secunderabad	2,370	55	23·21

Clinical Aspects of the Disease, Secunderabad.

Duration of symptoms in days	Protected cases		Unprotected cases	
Abdominal pain	1·50	(1·83)	1·76	(1·73)
Persistence of blood and mucus ..	2·50	(2·43)	2·95	(2·59)
Persistence of mucus only	3·83	(4·16)	3·69	(3·67)
Duration of fever	1·00	(1·43)	1·23	(1·19)
Highest temperature recorded ..	103° F.		102·6° F.	

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POONA AND SECUNDERABAD FINDINGS COMBINED.

A. Definite bacillary dysentery cases only.

	Strength	Number of cases	Ratio per 1,000
Protected	1,400	28	20·00
Unprotected	3,680	52	14·10
Totals	5,080	80	15·75

B.—Definite bacillary dysentery cases plus unclassified cases.

Protected	1,400	31	22·14
Unprotected	3,680	63	17·12
Totals	5,080	94	18·50

CLINICAL FINDINGS, POONA AND SECUNDERABAD COMBINED.

Duration of symptoms in days	Protected cases	Unprotected cases
Abdominal pain	1·39 (1·55)	.. 1·63 (1·59)
Persistence of blood and mucus ..	2·32 (2·23)	2·35 (2·13)
Persistence of mucus only	3·87 (3·95)	3·20 (3·23)
Duration of fever	1·00 (1·19)	1·44 (1·32)
Highest temperature recorded ..	103° F.	104° F.

SUMMARY.

(1) The efficacy of anti-dysenteric bilivaccin as a prophylactic against bacillary dysentery was tried out among the British troops stationed at Poona and Secunderbad. At Poona with a British garrison of 2,710 men, 1,106 (41·0 per cent) were protected, while at Secunderabad with a British garrison of 2,370 men, 294 (12·7 per cent) were protected. The total number protected was 1,400 out of a total of 5,080 (27·6 per cent).

(2) Alternative records are presented, the first dealing with definite cases of bacillary dysentery, the second including unclassified cases in addition to definite cases.

(3) A few records, showing the clinical aspect of the disease among the protected and the unprotected, are also presented.

CONCLUSIONS.

Oral bilivaccin failed as a prophylactic against bacillary dysentery during our investigations at Poona and Secunderabad.

The clinical course of the disease did not appear to be modified in individuals protected by the vaccine.

We have to thank Major Pottinger, M.C., R.A.M.C., and Major Stevenson, R.A.M.C., for supplying us with clinical records of all cases of dysentery treated by them during the period of this investigation, at Poona and Secunderabad respectively.

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BUSRA WALLAH.

By Lieutenant-Colonel H. B. KELLY, D.S.O.,
Royal Army Medical Corps.

To those who regularly study the Journal of the Royal Army Medical Corps it must be quite obvious that a considerable diversity of opinion still exists as to what form a Medical Appreciation of a military situation should take, and further, the numerous articles and appreciations that have appeared from time to time clearly indicate that the time has come when a standard form of Medical Appreciations should be agreed upon and adhered to; until such time as a standard is arrived at we must expect the controversy to be continued, and this must be my excuse for a "still further appreciation." One cannot fail to sympathise with candidates for promotion to Lieutenant-Colonel, they hope against hope that their particular effort may fall in with the particular examiner's views, some are afraid to say too much, others that they may not say enough, and so on. My own view is that the appreciation should be very short; it should consist of conclusions; how these conclusions are arrived at constitutes the what may may be called academic knowledge, and may be elaborated in detail in the appendices; if the General Officer Commanding wishes for confirmation of how the conclusions are arrived at, he has but to turn to the appendices; if he accepts the conclusions the appreciation will not occupy too much of his already fully-occupied time. Speaking generally, I do not think we have yet clearly differentiated between a Military and a Medical Appreciation. For instance, it is very important for a General Officer Commanding to keep his object clearly before him, but it seems obviously superfluous to say the object of the Deputy-Director of Medical Services is to arrange for the care and evacuation of sick and wounded; this is an obvious fact. I have in mind seven appreciations written by candidates at recent examinations; it is interesting to study the diversity of the headings, no two are alike. I may say here for the benefit of future candidates that my experience is that examining boards are composed of reasonable beings hoping to be able to pass the harassed Major, Royal Army Medical Corps, and that they fully recognize his difficulties and give due credit for an appreciation even though it may not coincide in its form with their particular views providing it indicates study and a knowledge of the subject. Another point: it is the custom in setting a scheme to detail the Medical Units, and then expect the candidates to agree or disagree, as the case may be. I suggest in actual practice, except for a definitely prepared mobilization scheme to which medical units may be definitely allotted in accordance with war establishments, it would be left to the Deputy-Director of Medical Services to state his requirements after he has appreciated the situation; this also

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gives him the opportunity of modifying his units both as regards numbers, type, transport, personnel and equipment. It would therefore in my opinion be better not to detail the Medical Units but to leave the choice to the candidate.

Now let us for a moment approach a Medical Appreciation from a practical point of view, and consider, if really faced with the problem of making the medical arrangements for a particular campaign, what would one really think out; obviously the first consideration would be, how many sick am I going to deal with?

(1) *Heading No.* 1.—*Estimate of Number of Sick.*—(*a*) During concentration; (*b*) during the campaign.

Now in estimating the number of sick academic knowledge comes in, as already stated, and can be dealt with in Appendix I.—How the estimate of sick is arrived at.

(2) *Heading No.* 2.—*Estimate of Number of Wounded.*

Appendix II.—How the estimate of wounded is arrived at.

(3) *Heading No.* 3.—*Total Number of Beds Required for Sick and Wounded.*

(4) *Heading No.* 4.—*Medical Units Required.*

Appendix III will give your reasons for any departure from war establishments, and your reasons for suggested alterations in transport, personnel and equipment.

(5) *Heading No.* 5.—*Order of Priority of Medical Units and where Required.*

Appendix IV.—Reasons for order of priority and the PLAN for utilizing these Medical Units for the clearance of sick and wounded.

(6) *Heading No.* 6.—*Recommendations for counteracting the factors concerned in causation of disease and sanitary recommendations for inclusion in Force Standing Orders.* These are included in Appendix V.

We will now proceed to consider the above in detail. For purpose of illustration each heading will be followed by its appendix:—

The appreciation will be marked SECRET, by . . . . . Map reference, place, date, and will read:—

(I) *Sick.* (*a*) *During mobilization.* Arrangements have been made for all sick during the concentration period to be dealt with by existing peace hospitals in accordance with mobilization scheme. Expeditionary force units will thus not be hampered.

(*b*) *During Campaign.*—"S" number beds will be required for sick.

APPENDIX I.

Estimation of Sick.—We know from experience the usual daily admission rate for troops serving under normal conditions is 3 per 1,000. But the following factors being considered will $\frac{\text{decrease}}{\text{increase}}$? this daily

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admission rate. The troops have all been medically examined on mobilization and unfits rejected, they are fully protected against smallpox and the enteric group diseases.

Climate, topography, water supplies, food supplies, prevalent diseases[1] are such as to $\frac{\text{decrease}}{\text{increase}}$? the normal admission rate which I estimate will be X per 1,000. The strength of the whole force being Y thousands the daily admission rate will be X multiplied by Y = Z. We know by experience that at the end of twenty-one days the admission rate is stabilized by the discharges and therefore the maximum number of beds required for the force is Z × 21 = S. From this must be deducted the discharges during twenty-one days calculated at 40 per cent the daily admission rate from seventh to nineteenth day, 90 per cent from twentieth day, 10 per cent invalided from tenth day, the position of stability being thus reached on twenty-first day.

(2) *Wounded.*—I estimate we shall require " W " beds for wounded.

We know from experience that the number of wounded is estimated at 20 per cent the force engaged, or at 20 per cent of three-fifths the total force (which is the force engaged); of these 20 per cent are killed or missing and do not, therefore, require hospital accommodation. The nature of the enemy's armament[2] is such as to expect a $\frac{\text{decrease}}{\text{increase}}$? in the above averages. Knowing the strength of the force a simple calculation gives the total beds required for wounded.

(3) *The total number of beds required for sick and wounded* will be S + W and allowing 10 per cent spare beds and considering the capabilities of expansion of the Base Medical Units I consider S + W + 10 cent. will be sufficient for my requirements and allow for sick and wounded prisoners of war.

(4) *I require the following Medical Units mobilized.*

N.B.—Leave out those not required and estimate according to strength of force and nature of operations.

Here also give any alterations you require in personnel, transport or equipment, according to the nature of the country and intended plan of operations.

---

[1] The above are the usual factors to be taken into consideration as likely to affect the health of the troops and are usually given under headings, factors which influence me in attaining my object, i.e., clearing and caring for sick.

[2] Anything from modern artillery to bows and arrows and may include special arrangements for gas warfare.

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(1) Cavalry Field Ambulances.
(2) Field Ambulances.
(3) Field Hygiene Sections.
(4) Hygiene Sections (lines of communication).
(5) Hygiene Sections (non-Divisional).
(6) Motor Ambulance Convoys.
(7) Ambulance Car Companies.
(8) Ambulance Trains.
(9) Hospital Ships.
(10) Casualty Clearing Stations.
(11) General Hospitals (600 beds).
(12) General Hospitals (1,200 beds).
(13) Convalescent Depots.
(14) Mobile Hygiene Laboratories.
(15) Mobile Bacteriological Laboratories.
(16) Advanced Depot of Medical Stores.
(17) Base Depot of Medical Stores.
(18) Red Cross Hospitals.
(19) Mobile X-ray Units.

APPENDIX III.

This will give the reasons for any departure from the normal allotment of Medical Units as laid down in War Establishments, and any reasons for additions to or subtractions from personnel, equipment and transport; they will obviously depend on the situation, intention and object of the General Officer Commanding, e.g., if the force is not proceeding overseas it is obvious no hospital ships will be required. If operating in a country where it was obvious the troops must deploy at some distance from roads a modification of transport must be recommended and may be donkeys, riding mules, pack mules, human carriers, camel cacolets, desert carts, light ambulance wagons, dandies and bearers, aeroplanes, &c. In estimating number of motor ambulance convoys and hospitals trains it will be necessary in this appendix to give data at which rate of evacuation may be carried out. It will be useful to remember one motor ambulance convoy = 75 cars, less 10 per cent under repairs; each car can carry 4 lying and 2 sitting, or 10 sitting, will travel on average 10 miles per hour and allow one hour for loading and one hour for unloading. A hospital train carries roughly 500 patients, will be delayed at unloading station about twelve hours, and usually owing to congested state of lines of communication only travels about ten miles per hour.

N.B.—The medical arrangements for the Shanghai Defence Force is a typical example of how Medical Units were modified in numbers, personnel and equipment to meet the expected requirements, and really illustrates and bears out arguments put forward in this article, especially in Appendix III above.

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(5) *Order of Priority of Medical Units.*—I require my Medical Units at X places on Z dates. Here will follow list in order of priority and mobilization stations according to the situation.

APPENDIX IV

will give the PLAN for utilizing these Medical Units for the clearance of sick and wounded, and will also explain how the order of priority is essential for your PLAN.

(6) *Recommendations for counteracting the factors concerned in the causation of diseases and sanitary recommendations for inclusion in Force Standing Orders.* These are included in Appendix V.

APPENDIX V.

In making these recommendations we must not include routine matters which nowadays all officers are supposed to know, e.g., for camps of one night shallow trench latrines will be dug. But recommendations to counteract the special factors appreciated in your estimate of sick must be included in detail, e.g., in a country in which we know that diseases caused by sun, mosquitoes, sandflies, polluted water, milk and vegetables, tropical ulcer and beri-beri are prevalent, special instructions must be included in detail.

CONCLUSION.

When the columns of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS were first thrown open if I remember correctly criticism was not invited. I agree with two well-known writers that destructive criticism makes the perpetrator an unpleasant and unprofitable member of society, but constructive criticism may, in my opinion, be most useful and profitable, and personally I should welcome it if it would help in elucidating the problem under discussion. I may forestall a possible comment that my appendices are too long and my conclusions too short. In my opinion the method suggested helps to keep the situation clearly before you, it is after all the conclusions that matter and the appendices keep the reasons for the faith that is in you that your plan will succeed, concisely and clearly before your mind's eye.

N.B.—The figures, calculations, &c., in this article have been taken from various articles which have appeared from time to time in the Journal. The only originality in this paper may be the suggested arrangements of headings.

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Editorial.

IODINE IN NUTRITION.

RECENT research has clearly demonstrated the importance of the mineral constituents in a diet. A proper balance, both qualitative and quantitative, of these substances is just as necessary from a physiological point of view as a due supply of proteins, fats, carbohydrates and vitamins. Mineral constituents are present in practically every food taken in an ordinary diet, and it has usually been taken for granted that they are normally supplied in due amount and variety, and disturbances in animal life have not been attributed until comparatively recent years to a shortage of mineral matter.

Iodine has been shown to be absolutely essential for the maintenance of the physiological balance of the animal organism. The most marked disturbance in men and warm-blooded organisms is associated with the thyroid gland, which seems to control the iodine exchanges of the body.

Dr. Orr and Dr. Leitch have compiled a report on Iodine in Nutrition for the Rowett Research Institute, Aberdeen, which has been published by the Medical Research Council. In the historical survey they point out that iodine was discovered in marine products by Davy in 1815, and by Staub and Fyfe in 1819. In 1820 Coindet, a physician in Geneva, suggested that the beneficial effect of marine products in goitre might be due to the iodine they contain. He found that the administration of iodine to patients with goitre led to the disappearance of the goitre, but in some cases toxic symptoms followed the treatment. Numerous physicians confirmed Coindet's results and d'Espine estimated the minimum curative dose at 0·5 milligramme a day.

In 1849 Prévost, who was already familiar with the therapeutic use of iodine, put forward the suggestion that goitre was due to deficiency of iodine and bromine in drinking water. In 1850 Chatin, a Professor of Pharmacy in Paris, found that iodine is universally present in nature, but the amounts in different soils, water, and plants vary. In goitre districts the iodine content of water and food was low, and he advanced, probably without knowledge of Prévost's suggestion, the hypothesis that goitre is due to deficiency of iodine.

The French Academy of Science appointed a commission which confirmed the universal presence of iodine in nature, but could not accept the idea that such small amounts of iodine would have any effect on the human body. As a result of the commission's findings Chatin's theory fell into discredit in scientific circles.

In 1855 Koestl proposed the use of iodized salt in Austria; and Lambroso, in 1859, recommended that as a means of preventing cretinism, goitrous

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individuals of marriageable age should be treated with iodine. In 1860 an experiment with iodized salt was carried out in three French Departments: school children, in addition to the salt, were given one centigramme of potassium iodide per day in tablets. These doses caused toxic symptoms and the experiment was abandoned.

In 1895 Baumann discovered iodine in the thyroid gland. He then set out to determine whether goitrous glands contained as much iodine as normal glands, and found that the percentage of iodine in goitrous glands was much reduced. This discovery was followed by a revival of the prophylaxis of goitre by iodine, and in the new experiments over-dosage was avoided. Galli-Valerio and Grassi recommended that school children should receive one drop of tincture of iodine per day, and in the district of Valtellina excellent results were obtained. In the Canton Appenzell iodized salt became general in 1922, and by 1925 it was reported that no more cretins were born and congenital goitre had practically disappeared.

In America, Marine determined the iodine content of thyroid glands in domestic animals and confirmed Baumann's discovery that goitrous glands contain less than the normal. In 1918 he published the results of his experiments on school children in Akron, Ohio, showing a reduction in the size of goitres following the administration of potassium iodide.

One of the chief difficulties in iodine investigations has been the lack of an exact method of determining the small quantities of iodine in plants and animal tissues, and it is only within the last two or three years that sufficiently accurate methods have been devised. Probably the best of these are modifications of v. Fellenberg's. By his method v. Fellenberg was able to show that the excretion of iodine in urine was less in the inhabitants of goitrous areas than in those of goitre-free areas.

In Part II of their paper Drs. Orr and Leitch give a detailed account of the distribution of iodine in nature. Though very widely distributed it is present both in plant and animal tissues in very small quantities, and the common method of reckoning is in millionths of a gramme, and for this unit the symbol γ is used. It is only in a few substances, such as the saltpetre deposits of Chile and Bolivia and in some sponges, that concentrations up to 0·1 or 0·2 per cent occur.

The amount of iodine found in soils varies from 600 γ to about 6,000 γ per kilogramme and the contents appear to be greater than that of the rocks from which they are derived. Plants have a great power of concentrating iodine, and the retention of iodine in the resulting humus of soil, while the other constituents of the weathered rock are carried off in drainage water, is one of the main factors in increasing the percentage of iodine in soils.

As regards fresh-water supplies, Chatin found that water from formations rich in lime and magnesium contained very little iodine. Von Fellenberg found 0·38 γ per litre in water from the Emme. The Arno above Florence contained 0·75 γ per litre. Orr, Godden and Dundas found in the River Dee (Aberdeen) from 0·5 to 0·71 γ per litre.

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Sea water contains from 17 to 18 γ per litre. Seaweed contains amounts up to 2,640,000 γ per kilogramme dry substance.

In water supplies in America amounts of iodine varying from 0·01 to 9·5 γ per litre have been found. In twenty water supplies in England and Scotland, analysed at the Rowett Institute, the amount varied from 0·05 γ to 4·2 γ per litre.

Sea plants are much richer in iodine than fresh-water plants, and the latter are in turn richer than land plants.

Fyfe, of Edinburgh, was the first to demonstrate the presence of iodine in animal tissues and, as we have already mentioned, Baumann, in 1895, found iodine in the thyroid gland.

The iodine intake is the most important factor affecting the percentage of iodine in the thyroid. There is a seasonal variation in the iodine content of the thyroids in ruminants, a maximum in the autumn and a minimum in spring. This is probably correlated with the amount of iodine in the pastures. Baumann noticed that in sheep and humans there was an inverse relationship between the size of the thyroid and the percentage of iodine. This was confirmed by Marine, Lenhart, Aldrich and Martin. Glands above a certain weight are usually eliminated in selecting thyroids for the preparation of a standard Thyroideum siccum.

According to Orr the average figure for human thyroid iodine is 7·8 milligramme, which would be about 60 per cent of the total body iodine.

Iodine is an unfailing constituent of milk, and the content depends to a great extent on the intake of iodine and may be raised to a very high level.

The effect of iodine in plant metabolism is to stimulate growth. The activity of nitrifying bacteria is increased, and the assimilation of nitrogen promoted.

In studying the influence of iodine on animal metabolism it is difficult, and in many cases impossible, to distinguish between the direct action of iodine ions *per se* and their indirect action through their influence on the thyroid secretion. The administration of potassium iodide to animals appears to stimulate growth. In the case of calves iodine up to 0·05 milligramme per day has a beneficial effect, but beyond this amount toxic effects are produced. In pigs, however, no toxic effects were noticed with much larger doses.

There is little information of the effect of iodine on the growth of children, and what we have comes from goitre areas. In Cumberland Fraser found that after iodine treatment there was "in practically every case a marked improvement in health and physique, a gain in weight, in energy and in working capacity."

A comparison of the effects of iodine and thyroid secretion on growth shows that the lack of either will result in subnormal growth. In animals excess of thyroid both limits growth and causes abnormal development. This, however, is not due to the iodine contained in the thyroid secretion. The effects of the thyroid secretion are more complex than those which result from the presence of iodine ions.

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It appears that iodine *per se* is not the active agent in inducing metamorphosis, but is merely an essential constituent of a compound which under normal circumstances is elaborated by the thyroid and which in the absence of the thyroid can be elaborated by the pituitary.

Experiments have shown that regulation of the basal metabolic rate is one of the main functions of the thyroid. In the absence of thyroid secretion either in thyroidectomized animals or in myxœdema, the rate is subnormal, and the administration of the secretion raises the rate both in normal subjects and in cases where there is lack of thyroid secretion. The rise in the rate is due to increased carbohydrate metabolism. There is experimental evidence that iodine tends to lower the basal metabolic rate and so causes increased sugar tolerance in diabetes complicated by exophthalmic goitre. Whether the same is true in diabetes uncomplicated by hyperthyroidism is unknown.

Drs. Orr and Leitch then give detailed information on the effect of iodine on various organs and tissues other than the thyroid. They say that the available information suggests that iodine stimulates intestinal movements and excessive doses cause diarrhœa. Thyroid appears to have a somewhat similar effect. Most of the observations with thyroid have, however, been made on subjects with abnormal glands.

Veil and Sturm, in 1925, found that in normal blood sixty-five per cent of the iodine is in organic combination. They found that 0·5 gramme of potassium iodide raised the blood-iodine from 15 γ to 1308 γ per 100 cubic centimetres, but the normal level was reached again at the end of forty-eight hours. In one case the organic iodine in the blood was found to decrease with the rise of the total iodine, and remained at the lower level for twenty-four hours. This finding may offer an explanation of the beneficial effects of inorganic iodine in exophthalmic goitre.

At the Rowett Institute, Orr and Leitch found the blood-iodine falls after thyroidectomy. Thyroid administration increases the red blood-count, but an overdose may produce symptoms of thyroidism.

Orr found in rabbits receiving a small daily dose of iodine a marked increase in the coagulability of the blood as compared with the controls.

It is a well-established fact that thyroid administration increases the pulse-rate both in normal and hypothyroid cases. Blalock and Harrison, in 1927, found that thyroid feeding in daily doses of 0·7 gramme for four to six weeks caused an increase of the cardiac output of 80 to 120 per cent. The oxygen consumption was increased sixty to eighty per cent. After omission of thyroid the rate of oxygen consumption returned to normal more rapidly than the cardiac output. These results seem to indicate that the thyroid may have a specific effect on the myocardium. Thyroidectomy caused a diminution of cardiac output greater than the decrease in oxygen consumption.

As regards the sex organs, experiments on animals appear to show that

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the thyroid is necessary for their normal growth and function, but excess of thyroid interferes with sexual development and activity. The effect of iodine is similar. As regards the mammary glands, Drs. Orr and Leitch found at the Rowett Institute no harmful effect on milk secretion of moderate doses of iodine. Any well-balanced ration will probably contain sufficient iodine, and it is unlikely that further addition will stimulate the secretion of milk.

In the last sections of their paper Drs. Orr and Leitch give a summary of the changes in metabolism and structure of the thyroid in goitre, the use of iodine in the treatment and prevention of goitre, and the iodine requirements in animals and in man.

They describe briefly the changes which take place in the normal thyroid from infancy to adolescence. The increase in size in the thyroid at puberty is due both to accumulation of colloid material and proliferation of epithelium.

In 1896 Baumann isolated from the thyroid an organic iodine-containing compound (thyroidin) which he showed had the physiological properties of the whole gland. In 1919 Kendall isolated in a crystalline form a substance which he called thyroxin. Boothby and Sandiford, in 1924, showed this substance had the main physiological properties of the thyroid.

Harington improved the method of isolating thyroxin and gave it the formula $C_{15}H_{11}O_4NI_4$; he was also successful in synthetizing the substance. It was thought at one time that the physiological effects of thyroxin (hormone) were due to the organic portion of the molecule, but the work of Abelin has shown that the presence of iodine in the thyroxin molecule is necessary for its full physiological activity.

Tatum and van Dyke found that in the thyroid of animals the colloid contained more iodine than the cells, and van Dyke found this to be true for human thyroids. The colloid was thought to be absorbed by the lymph, but according to Carlson and Woelfel and Hicks, it is probably by the blood-stream. The transition from the colloid-rich to the colloid-free condition may be extremely rapid. There is a relationship between the thyroid and ovarian function which requires a periodic mobilization of iodine and a depletion of the iodine store. Farrant has shown that there is a rapid mobilization of thyroid colloid in response to certain acute infections, notably diphtheria and measles, with a consequent drain on the iodine store of the body.

In simple goitre the structure and mode of development of the thyroid are normal, but the entire process of growth and colloid accumulation is exaggerated. Adenomata occur equally in the normal and goitrous gland; the only essential difference is the rate of growth. According to Aschoff and Holst, they approximate in nature to new growths and form the basis of most malignant tumours of the thyroid. Attempts have been made to ascertain whether the secretion of goitrous glands is normal in quality and amount. In thirteen cases of adenomatous goitre Weir found the amount

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of iodine present as thyroxin was reduced in proportion to the total iodine content.

The districts in which goitre occurs are usually mountainous, but not all such districts are affected. In New Zealand goitre is most frequently associated with river beds, and the same association is seen in America in the region of the St. Lawrence and the Great Lakes.

Goitre in domestic animals appears to occur in the same districts as goitre in human beings.

The low percentage of iodine content in goitrous glands suggests that the iodine intake in goitrous areas may be low. A comparative study of the iodine contents of human foodstuffs from goitre areas and non-goitre areas supports this view. The difference in the daily intake has been found to be about 18 γ in Switzerland and about 15 γ in New Zealand.

The rôle of iodine in the treatment and prevention of simple goitre also affords evidence that deficiency of iodine may have a causal relationship to overgrowth of the thyroid.

Excess of calcium in drinking water and food and the contamination of water supplies with micro-organisms have been supposed to have an effect in the production of goitre. But there is no real evidence to show that calcium has any influence on the growth of the thyroid, and the experiments of the Swiss Goitre Commission gave no support to the theory that goitre is due to the ingestion of contaminated water or food. Such a theory is also inadequate to explain the age and sex distribution of the disease. Such infections and toxæmias, by depleting the thyroid of iodine, might contribute an iodine deficiency.

We have already referred to Marine's work on the treatment of goitrous animals and the success which attended the treatment of children in Ohio; and to the use of iodine for goitrous children in Switzerland, New Zealand and parts of England. The most recent results in Swiss schools and in Austria showed similar beneficial effects following the administration of iodine. Summarizing the results, Drs. Orr and Leitch say that in the vast majority of cases administration of iodine arrests the growth and reduces the size of goitrous glands. The effect is greater the earlier the treatment is applied. After puberty the efficacy of the treatment is reduced, and after twenty is practically confined to soft parenchymatous glands, hard and nodular goitres giving little or no response. The use of iodized salt by pregnant women prevents the birth of goitrous children.

Toxic symptoms described as hyperthyroidism have been stated to follow the administration of iodine in adults. A critical examination of the cases has shown that the symptoms were mainly caused by excessive doses of iodine and reliable observers have never seen toxic symptoms following the use of iodized salt.

From experiments that have been made by v. Fellenberg and others, it may be deduced that the minimum amount of iodine required for equilibrium in the adult male is about 15 γ per day, and in a child about 50 γ.

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Since exercise and excitement increase the requirements a liberal margin of safety is necessary, and on analogy with the requirements of other mineral substances, the minimum daily requirements may therefore be about 45 γ for an adult and 150 γ for a child.

The doses of iodine which were given to prevent goitre by Kimball and and Marine at Akron, eleven milligrammes a day, and by Hercus, Benson and Carter in New Zealand, seven to twenty-one milligrammes a day, are far outside the limits of physiological intake. Marine now considers five to ten milligrammes a week is sufficient for preventive purposes, and a somewhat higher dose for curative measures. In 1921 Klinger, in Zurich, gave fifteen milligrammes a week for eighteen months and in subsequent work the dosage has been lower.

Hunziker and Eggenberger, in their Appenzell experiments, used a salt containing one gramme of potassium iodide to 100 kilogrammes salt. This gives a daily dose of 0·1 milligramme if the salt is used at table only. The salt (1-100,000) was found to be eminently successful in the treatment of goitre in school children, and in the prevention of congenital goitre. Since 1922 no children with congenital goitre have been born from women using iodized salt for at least five months of the pregnancy. If it is used for cooking, baking and all purposes, then a salt of half this strength, 1-200,000, would be sufficient to give the same daily dose. This is the dosage adopted by the Swiss Goitre Commission.

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Clinical and other Notes.

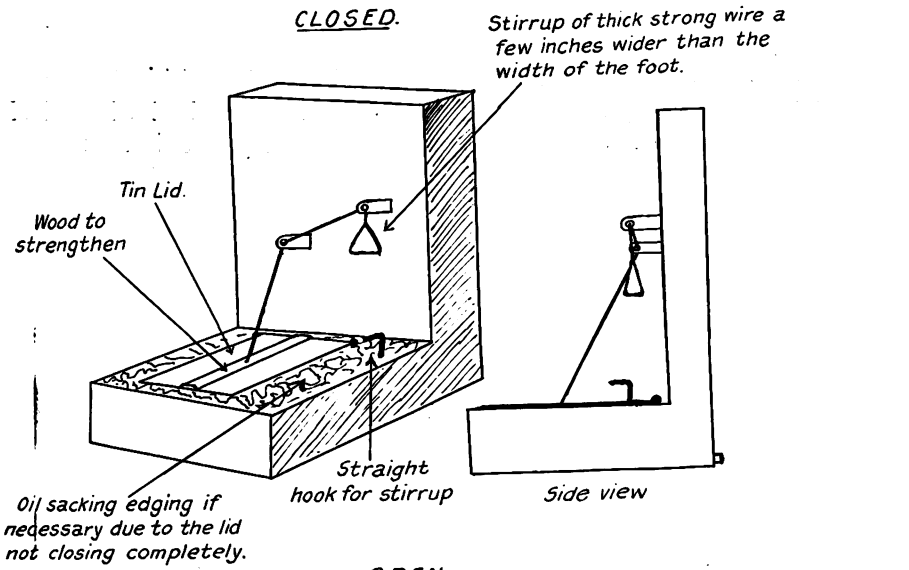
A METHOD OF FLY-PROOFING IN INDIAN LATRINES.

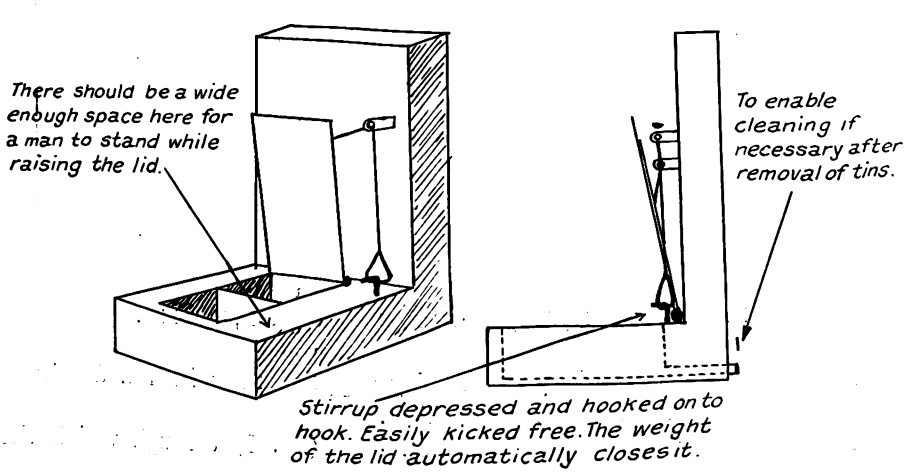
By Major H. HORAN BROWN,
Indian Medical Service.

A great difficulty in the fly-proofing of latrine pans in India is the caste prejudice against *touching* any part of the latrine.

The method suggested in the following diagram overcomes this difficulty in that only the foot is used.

The user puts his foot in the stirrup, depresses the stirrup and pushes it on to the peg.





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After use, he kicks the stirrup free and the lid falls.

The only cost should be occasional renewing of the wire rope between the lid and the stirrup.

The floor should be sloped slightly downwards and backwards for the tin receptacles to facilitate cleaning.

Advantages.—(*a*) Caste prejudice to touching the lid is overcome; (*b*) fly proof; (*c*) cheap; (*d*) easily attached to any present latrine.

BOURGAULT'S CATTLE-FLY TRAP.

By Major W. F. M. LOUGHNAN, M.C.,
Royal Army Medical Corps.

When recently visiting Ferney Sugar Estate, Mauritius, I was much struck with the simple and efficient fly-trap invented by M. Leon R. L. Bourgault du Coudray, the description of which may be of interest to some of our readers.

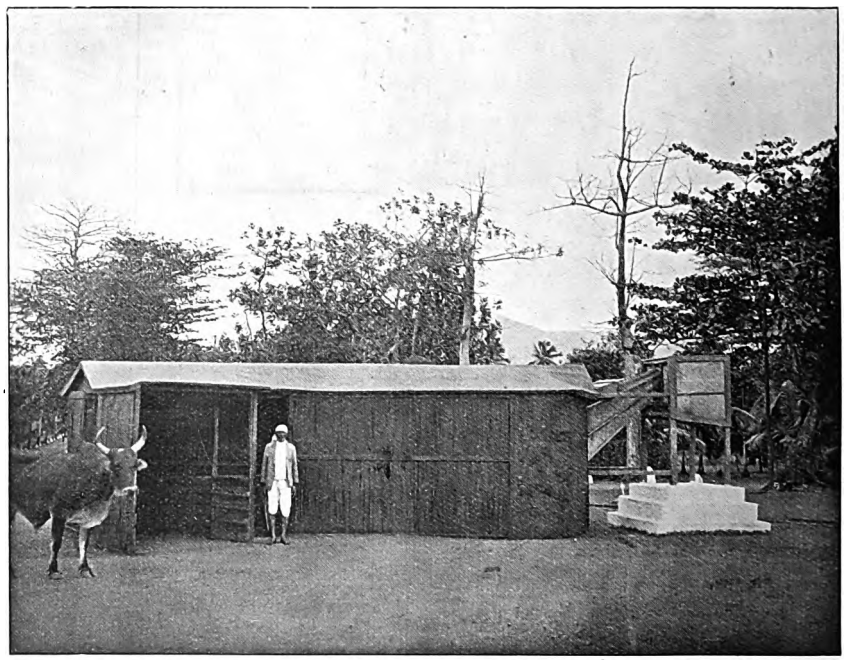


Fig. 1.—Cattle Fly Trap at "Ferney" Sugar Estate, Mauritius.

M. Bourgault du Coudray has kindly supplied me with full details of his invention and the method of working.

The trap consists of a darkened building (fig. 1) through which the

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cattle walk and brush off or disturb any flies which may be on them, and the natural tendency of these insects to seek the light is utilized to attract them into a destructor trap.

The diagram (fig. 3) shows the arrangement of the building with passages 7, 4, 9, etc., through which the animals pass. Owing to a sudden change in the direction after entering at 2 and passing along 7, the oxen

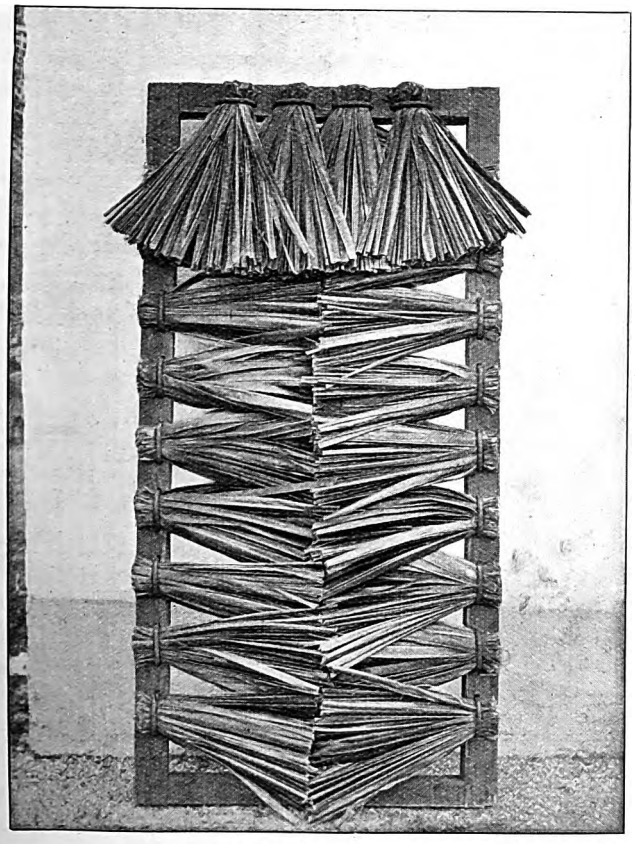


FIG. 2.—The brushing device through which the animals have to pass. The brushes are made of coco leaves.

enter a second passage 4 from whence they must pass through the brushes partition 13, made of branches and leaves (coco leaves) (fig. 2).

The flies are thus brushed off the animals and make for the nearest source of light at point 8, which enters the building through a metallic gauze trap 16, and they remain in part 18, and are destroyed there in a suitable manner.

The cattle, now completely rid of their flies, walk on in semi-darkness around the corner 10 along 9 until they reach the exit 3 of the structure.

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The species of flies most commonly found on cattle in Mauritius are stomoxys and, to a small extent, the common house-fly.

The process is simplicity in itself. Ten minutes is sufficient time to send a hundred oxen through the trap. After the end of the second day the animals pass through it quite willingly and seem to realize its advantages quite soon, as the oxen, immediately on being released from their carts, go to the trap themselves and sometimes even at a gallop.

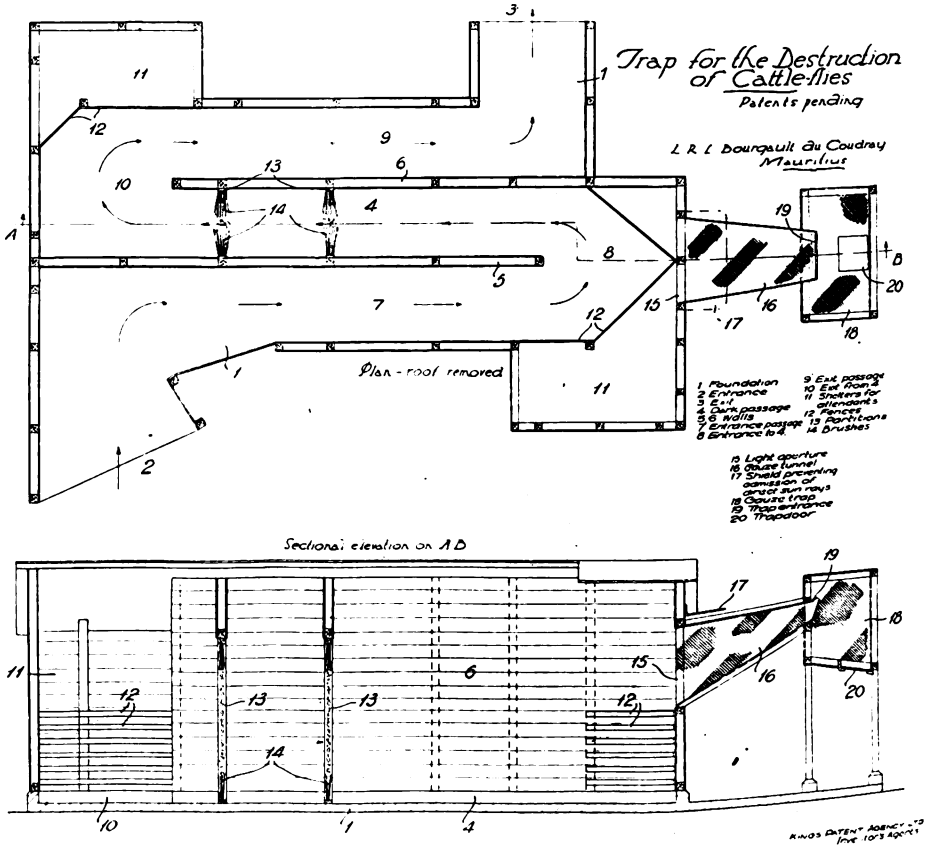


FIG. 3.

During the bad fly season, in addition to passing the herds through the trap each time they go in and out of the stables and to and from the pasture lands, it has been found useful to employ a black bullock as a decoy (if possible tailless). The animal is driven by a boy round the vicinity and finally to the trap when some flies have collected on the beast.

The results obtained from the outset were astonishing. Working with a hundred oxen on the Ferney Sugar Estate in January, 1928, 208,000 flies were destroyed during the first week, 198,000 during the second, and

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138,000 during the third. At the end of the first month the total number destroyed was 750,000.

In view of the fact that a very definite reduction in the number of house-flies was observed in dwellings on estates where the Bourgault fly-trap was in action, its use might be extended to the human species in camp, cantonments and trenching grounds in Egypt and India.

A number of house-flies are associated with stomoxys, and have been captured sucking the puncture left by the former. The common house-fly is also fond of alighting on the eyelids of oxen in order to imbibe the lachrymal fluid.

In the tsetse belts of Africa the application of the trap might be tried to some advantage for the reduction of the sleeping sickness fly.

Flies in Mauritius are a great pest to all animals. Stomoxys is the cause of considerable mortality amongst cattle from surra. Profound anæmia, marasmus, debility and diminished lactation are common amongst the herds in the Colony.

The trap is economical and not expensive to erect. A very small outlay is all that is required for the upkeep, namely, for the renewal of the brushes, which are generally composed of coco leaves, and last for six weeks or more. It is extremely simple and rapid in action, giving extraordinarily good results. There is no doubt that the device will be much appreciated and extensively used in tropical countries where flies are so numerous and troublesome to man and beast.

The Director of Agriculture, Mauritius, and the Government Veterinary Surgeon have testified in the highest terms to the undoubted value of the trap as a fly-catcher. Several estate managers and planters have also given testimony as to its great utility.

In conclusion I have to thank M. Leon R. L. Bourgault du Coudray for his notes and illustrations of the trap, which has been patented in Great Britain and several other countries.

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Echoes of the Past.

THE MEDICAL DEPARTMENT OF WELLINGTON'S ARMY, 1809-1814.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps.

(*Continued from p.* 146.)

1812.

In January a fresh attempt was made on Ciudad Rodrigo, which was taken by assault on the 19th after twelve days of open trenches. Our losses in killed and wounded were 553. A General Order issued at Gallegos on the 8th stated: "Each Division will be attended by the Medical Staff belonging to it. A place will be fixed upon to which men who may be wounded are to be carried, and means will be provided for removing them from thence to cantonments." The wounded seem to have been sent mainly to Coimbra. Those of the 4th Division, in defiance of orders, were retained by Guthrie in their Regimental Hospitals about Gallegos and Aldea del Opisbo.

On January 12 James McGrigor landed at Lisbon to assume the duties of Inspector of Hospitals to the Army. He was then a man of 40, who, after nine years' regimental service, had come to the front as Superintending Surgeon to Sir David Baird's force during the Egyptian campaign of 1801. He was later in charge of the Southern District at home, and had just returned from Walcheren where he had been sent to reorganize the medical arrangements. His reputation as a strong and capable administrator as well as a skilful physician was already made, and his personality rendered him no less acceptable to his subordinates than to the Commander of the Forces; for, though a hard taskmaster, he possessed the gift of sympathy combined with a jealous regard for the welfare of his officers.

An inspection of the Lisbon hospitals and depots convinced him that a drastic system of weeding out was required, and that it was not the private soldier only who found the suburbs of that town more attractive than regimental duty. On his advice, regular medical examinations by a standing medical board was instituted, and all patients were boarded at the front before being sent down to the base. He believed strongly in the value of Regimental Hospitals, and was anxious to see a number of small hospitals established in divisional areas where men should be treated by their own surgeons, but this Wellington could not at first agree to, for reasons already mentioned.

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In March the siege of Badajoz commenced again. McGrigor established his office at Elvas, about fourteen miles from the town where the medical supply depot was located. He had brought out a staff officer, Staff Surgeon James Forbes, with him from England and was thus able to keep in personal touch with the Commander of the Forces, whom he saw every morning and from whom he obtained information as to all movements of importance. A small field hospital was formed and a daily convoy of wagons was arranged between the front area and the hospitals at Elvas.

The final assault, in which three-fourths of the 5,000 casualties of the siege occurred,[1] was made on the night of April 16. The Fourth and Light Divisions, who attacked the breaches, were driven back with heavy loss, but, in the end, Picton's Division effected a lodgement in the Castle. An aid post for the first two was formed at the Quarry, well within musket range, in charge of Staff Surgeon Burnall, with whom was Assistant Surgeon Elkington of the 24th, a regiment not directly engaged. When the two divisions retired completely broken, they were unable to afford much assistance. The severely wounded they could not reach, and the slightly wounded would not remain under fire to be dressed. McGrigor remained at Wellington's side throughout the night. The sack of the town lasted two days and was only stopped by summary executions. It took another twenty-four hours to get all the wounded in. Each fatigue party sent brought a certain number into the Convent of S. André in the city, but, instead of returning for more, they went off in search of loot.

The arduous work imposed on the Medical Department was well performed, and their gallantry under fire during the assault was recognized by Lord Wellington, at McGrigor's suggestion, by a mention of their services in his despatch. Thus a precedent was set, which was followed in the future, for never previously had a civil department of the Army been so mentioned.

The capture of Badajoz and Ciudad Rodrigo secured for the Army important potential bases for future operations. The French forces were scattered. Marmont had fallen back on Salamanca, and Soult was on the Guadalquivir. Wellington now prepared to advance against the first. General Hill was despatched in May with 6,000 men to attempt the destruction of the bridge-head at Almarez on the Tagus, and so sever the direct line of communication between the two French armies, an operation which was brilliantly performed. On June 13 Wellington crossed the Agueda.

To summarize the medical situation. At Lisbon there were the fixed hospitals and Convalescent Depots at Belem and Oeiras. Evacuation to that place was now, however, mainly confined to cases requiring embarkation

[1] Killed 1,035, wounded 3,789. 18,000 were engaged in the assault, of whom 823 were killed and 2,858 wounded.

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to England, 2,000 of which were despatched in July. Discipline at the depots was now properly maintained, and the depot at Oeiras was closed in August. Coimbra, on the navigable waters of the Mondego, had been an important medical centre throughout the war, except during the sojourn of the Army behind the defences of Torres Vedras. It was in communication with Lisbon either through Figueras by sea, or by road through Santarem, where there was still a sick depot. Abrantes on the Tagus, from whence ran the lines of communication with the troops guarding the eastern line of invasion, had a hospital establishment, and the hospitals established at Elvas, Estremoz, and Alter da Chao during the operations round Badajoz remained open. To provide for casualties on Hill's line of retreat the hospital at Estremoz had been cleared. On the road between Ciudad Rodrigo and Oporto there were hospitals at Celorico and Vizeu. By this line McGrigor was prepared to evacuate his sick to the transports if necessary. Apart from the three spring wagons with each division, the means available for moving the sick was the returning supply trains, consisting chiefly of commissariat mules.

Medical officers were short. There were no reserves with the Army, and regimental establishments still had to be depleted to supply the new General Hospitals formed.

On July 22 the battle of Salamanca was fought, and Marmont was driven over the Douro. Valladolid was occupied, and on August 21 Wellington entered Madrid.

Our losses at Salamanca amounted to 693 killed and 4,266 wounded in a force of about 45,000. By Wellington's orders large hospitals were opened in the town. Only the most severe cases were removed to Ciudad Rodrigo, provided they were fit to be moved at all. There was also considerable sickness, and he desired to get the men back to duty as early as possible. Writing from Flores de Avila on July 25, he assured McGrigor that he was very sensible of the diligence and attention of the Medical Department, "of which I have reported my sense to the Secretary of State." The sickness he ascribed largely to the "irregularities" of the troops "and the ignorant presumption of those who think they know better than those who have been serving long in the country." The battalions recently arrived from home and the Mediterranean had no capacity for marching, and their internal economy and sanitary discipline was bad.

McGrigor remained some time at Salamanca to supervise arrangements. Finding on his journey to Madrid that a number of sick had been left on the road unattended, he assumed the responsibility of ordering up medical officers and purveyors from Salamanca. Wellington, who scarcely permitted initiative of this sort even to his staff, was furious when he heard of it. But it was the thin end of the wedge, and henceforth McGrigor was tacitly allowed to carry out much of the arrangements connected with the sick and wounded on his own responsibility.

Burgos was now invested. A garrison was left in Madrid under Hill's

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command, and George Guthrie remained there as his P.M.O. The sick and wounded from the main army at Burgos were sent off in daily convoys by returning transport to Valladolid. On September 5 the morning state showed 29,169 effectives, sick present 1,454, sick absent 16,375. At the commencement of the campaign in June the last figure was about 12,000. On October 21 the siege was abandoned, and Wellington, confronted by forces nearly treble his own, commenced his retirement. Shortly before, there had been nearly 2,000 casualties in the hospitals at Valladolid, but McGrigor had been carefully watching the military situation. He had on his own initiative arranged for the clearance of the whole line of hospitals as far as Oporto and, taking advantage of every opportunity, had nearly cleared the front. When he received orders to move at twelve hours' notice there remained no more than sixty patients, all unfit to be moved out of Valladolid. These were left, with three medical officers and a purveyor's clerk, to the care of the enemy.

The retreat went no further than Ciudad Rodrigo, a distance of 180 miles, which was covered in thirty-five days. The weather was vile, the roads worse, the arrangements for supplies broke down, and the soldiers were out of hand. It cost Wellington 9,000 men. At the termination of the march there were 20,000 sick men to be dealt with, and typhus had broken out. In December the deaths averaged 400 to 500 a week.

There was not accommodation for a tenth of the sick in the General Hospitals, and McGrigor took the opportunity to renew his proposals for the treatment of the bulk of the patients locally in Regimental Hospitals supervised by the Divisional Surgeons. A G.O. dated November 29 directed that "When the troops move into cantonments a Regimental Hospital is to be formed for each Corps. Dr. McGrigor will transmit directions respecting the move of those necessary to General Hospital." Typhus raged through December and January. The First Guards practically ceased to exist. But the system of treating the cases where they occurred, thereby limiting the movement of the affected population, was founded on sound principles, and in the early spring the epidemic wore itself out. Meanwhile, on McGrigor's suggestion, wooden frameworks for huts were sent out from England, and by the summer a village of cottages capable of accommodating 4,000 sick had been set down near Castello Rodrigo within reach of the navigable waters of the Douro. Attempts were made to supplement the medical staff by enlisting the services of French and Portuguese doctors, but it was not a success.

The Vittoria Campaign, 1813.

In May General Hospitals are mentioned at Coimbra, Vizeu, Celorico, Castello Branco, Abrantes, Santorem, and Lisbon. At the last Deputy Inspector Edward Tegart was in charge. No exertion was spared to get these hospitals cleared, and to return the convalescents to duty.

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The result was striking : the increase of the fighting strength of the Army by something like a division at the outset of the Vittoria campaign.[1]

Meanwhile Wellington had made every preparation for the operations of the summer. The discipline of the British troops was restored, reinforcements were received from England, and the Spanish army was more or less brought into line. The Portuguese under British officers were already troops to be relied on. In spite, however, of the efforts of Fergusson and his staff the sick wastage from their divisions continued to be high owing to the defective organization of their base hospitals.

"In the campaign of six weeks, commencing in May, 1813, Wellington marched 600 miles, passed six great rivers, gained one decisive battle, invested two fortresses, and drove 120,000 veteran troops from Spain." At Vittoria, on June 21, King Joseph's army was routed and broken with a loss to the allies of 5,176 casualties in a force of 80,000. Walter Henry, an Assistant Surgeon of the 2nd Division, has left a description of his own share in the battle :—

"Having from the commencement of the campaign been attached as Assistant to Staff Surgeon Wasdell, in medical charge of the 2nd Division, I moved with the headquarters of General Stewart and thus had the advantage of a wider range of observation and better accommodation than I should have had with my regiment. . . . When our division had advanced along the Vittoria road within long cannon range of the enemy's position, we were ordered into a field on the right and there halted. The Portuguese brigades of Sir Rowland Hill's Corps were also halted in the same place. The whole were ordered to pile their arms and walk about and refresh themselves for a few minutes while Sir Rowland Hill, General Stewart and a large staff including Mr. Wasdell and myself rode forward to a small height where there was a better view. But the mass of mounted officers having attracted the enemy's attention, a shot from one of the nearest batteries gave us a hint to keep our distance and the greater part of us were ordered away. Almost immediately afterwards General O'Callaghan's Brigade, consisting of the 28th, 34th and 39th regiments, marched to attack the village of Subijana D'Aliva half a mile to our front, and having there suffered a heavy loss, I was ordered to the assistance of the surgeons, and, soon after this, being the most pressing point, Mr. Wasdell joined us himself. We collected the wounded in a little hollow out of the direct line of fire, but within half musket-shot of the village, unpacked our panniers, and proceeded to our work. The Brigade had four or five hundred men killed and wounded in the course of an hour or two, so we were fully employed. A

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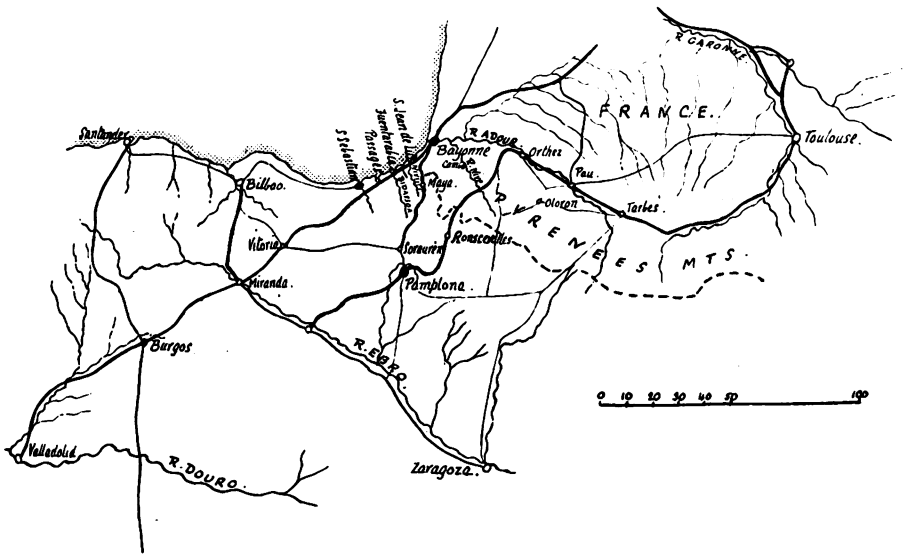
[1] The sick returns were as follows :—

	Effectives	Sick present	Sick absent
January 1 ..	33,542 ..	2,802 ..	14,896
March 7 ..	35,893 ..	4,310 ..	9,906
May 2	40,014 ..	2,701 ..	6,538

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stray cannon shot from a battery firing on the village would occasionally drop among us by way of an incentive to expeditious surgery, and, after one of these unpleasant visitors had made his harmless appearance, a young chirurgeon of my acquaintance became so nervous that, although half through his amputation of a poor fellow's thigh, he dropped the knife, and another hand was obliged to complete the operation. But this was only temporary weakness. At my suggestion he lay down on the grass, took a little brandy and soon recovered, and did good service the whole day. Spring wagons were in attendance, in which we placed the worst patients and sent them to Puebla, where Dr. McGrigor had, early in the day, made the most judicious arrangements for their accommodation.

"When Subijana was taken, and we had attended to all the wounded we could find, a message came to the Staff Surgeon from the Puebla



mountain on our right that our First Brigade had suffered great losses and required medical aid. I was again detached up the hill on this urgent requisition. When galloping up the hill, le Cor's Portuguese Division, belonging to Sir R. Hill's Corps, was moving up to the same place. The enemy dropped some shot and shell among them. When one of these fell amongst the columns there was an awful scream, not merely I believe from the men struck, but their comrades also, which never is the case when a British square is hit. I reached the top in time to witness the last moments of Colonel Cadogan of the 71st. I proceeded to assist the Medical Officers of the Brigade and remained with them until the urgency was over, returning thence to Subijana. The wood being now abandoned by the French light troops, and the artillery withdrawn from the hill behind, Mr. Wasdell, two other surgeons and myself here set to work afresh, after swallowing some wine and bread, and we remained collecting, dressing,

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amputating, packing the wounded into spring wagons and sending them to the temporary hospital till 7 o'clock. When our work was done and we had packed off every wounded man in the neighbourhood of the village, we pushed on to join the Division now far in front." [1]

After the battle of Vittoria, S. Sebastian was besieged and Pampeluna blockaded, while positions were occupied among the trackless mountains from Roncevalles westward to the sea. The northern Spanish ports, including Santander, Bilbao, and Passages were used, so far as the weather allowed, for landing supplies. The sick from the main army in the Pyrenees were mostly brought down to the hospitals at Vittoria, the first part of the journey in blankets slung on poles and carried by Spanish peasants. Rest stations (Passing Hospitals) were established on the route. A hospital, which included fifteen portable huts, each for fifty patients, was also opened at Santander, and two large establishments in a convent and a rope-walk near Bilbao. In the latter town wheeled traffic was forbidden and sledges had to be employed for ambulance work. Later a hospital and medical store depot were formed at Passages, and the civil hospital at Fuentarabia was occupied. Casualties from S. Sebastian were brought to Bilbao by sea. The Vittoria hospitals were cleared by evacuation to the coast, but means of transport were a constant difficulty.

At the end of July Soult struck at the right of our position, and during the last week of the month there was hard fighting among the mountains for which the honour "Pyrenees" was granted. The removal of the wounded after the engagement of Sorauren was a serious problem which called for all McGrigor's ingenuity. The horses of d'Urban's cavalry brigade were employed, and the wounded of both armies were collected in the village church of Berrioplano, and eventually removed in spring wagons and carts to Vittoria. On August 1 Wellington wrote: "Although our wounded men are numerous, I am happy to say the cases are, in general, slight, and I have great pleasure in reporting that the utmost attention has been paid to them by Inspector of Hospitals, Dr. McGrigor, and the Department under his direction." There was much hospital gangrene, but some progress had been made in treatment. The mortality seems to have been about thirty-two per cent. In general organization a great advance had been made, resulting in a decreased case mortality both for wounds and sickness. On August 24 the hospital establishment at Lisbon was closed. S. Sebastian fell by assault on August 31. On October 7 Pampeluna surrendered, and Wellington commenced the invasion of France by the crossing of the Bidassoa. In this operation two of the Divisional Surgeons, John Hennen and Theodore Gordon, were wounded.

Meanwhile the behaviour of the Spaniards, never particularly friendly, had become almost openly hostile, and caused special embarrassment to those responsible for the hospitals in the rear. At Santander the Health

[1] "Events of a Military Life."

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Officer, who had been invited to visit the hospital whenever he pleased, on the pretext that some of the patients looked rather jaundiced diagnosed yellow fever. A Spanish guard was put over the sick and the port placed in quarantine.

On November 10 Soult was driven from his fortified position on the Nivelle; on December 9 he was again defeated on the Nive. The General Hospital opened in the church at Cambo after this engagement remained open to the end of the war. On February 18 Wellington crossed the Adour, manœuvred Soult out of his position at Bayonne, and nine days later defeated him at Orthez. The war terminated with the battle of Toulouse on April 10, a hard fought battle in which the Allies lost 4,659 killed and wounded, or about 13 per cent. Of this battle, George Guthrie, who was present as a Deputy Inspector, says: "Nearly all the wounded had every possible assistance and comfort. The hospitals were well supplied with bedsteads, the medicines and materials were in profusion. The sick and wounded, 1,359, including 117 officers, were in charge of 2 Deputy Inspectors, 10 Staff Surgeons, 6 Apothecaries and 51 Assistant Staff Surgeons, and the whole worked from morning to evening with the greatest assiduity. The surgery of the Army was at its highest pitch of perfection it attained during the war; every broken thigh was in a straight splint, and the success greater than ever before."

In December the hospitals at Ciudad Rodrigo, Salamanca, and Toro had been closed. During this month those at Abrantes and Castello Branco were broken up. Besides the wounded at Toulouse there remained establishments at Orthez, Fuentarabia, Passages, and S. Jean de Luz. In May the patients in these were embarked for home, while many of the hospital stores and a number of the huts were despatched to the force engaged in America.

When the Army was broken up, almost all the senior medical officers, being without employment, were placed on half-pay. The doctors, as non-combatants, were ineligible for the Military Order of the Bath, but McGrigor became a Knight Batchelor and a Knight of Hanover. After the Walcheren campaign of 1809 the old Medical Board had given place to one of military officers consisting of a Director-General and two Principal Inspectors, and, after a few months of unemployment, he was appointed Director-General. This position he continued to hold for the next thirty-six years. George Guthrie enhanced his surgical reputation in civil practice. He worked hard during the remainder of his life to inculcate the correct principles of military surgery, and his clinic was free to the Medical Officers of both Services who desired to attend. He was three times President of the Royal College, and survived till the year following the Crimean War. James Franck died in 1843. Fergusson left the Army in 1817 and practised at Windsor, where his patients included members of the Royal Family. His "Notes and Recollections," published by his son after his death in 1846, are of permanent interest and value.

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AUTHORITIES.

For the medical history of the war, Sir James McGrigor's Autobiography, though all too brief, is a classic. Walter Henry's "Events of a Military Life" is a most readable book and gives some interesting details of the life of an Assistant Surgeon in the Peninsula. John Hennen's "Observations on Military Surgery" contain references to his experiences in Portugal and Belgium, and Charles Boutflower's Journal, and J. G. Van Milligan's "Stories of Torres Vedras" may also be mentioned, though of no great medical interest.[1] Guthrie's Clinical Lectures, first printed in the *Lancet* and reprinted in 1853 as "Commentaries on the Surgery of the War," contain many good stories and much caustic comment on medical military administration. Wellington's Despatches and the General Orders have numerous and important references to medical affairs, including a number of Morning States. The first is unfortunately not indexed. Napier and Sir John Fortescue are of course indispensable to the student of this period.

Sport.

SOME FISHING NOTES FROM THE U.P., INDIA.

By Major T. O. THOMPSON,
Royal Army Medical Corps.

Encouraged by the very favourable comments which were received by me, both in private letters and in some local newspapers, on a series of notes written some six years ago on fishing in the Nilghris, I am venturing once again into print in the hope that the following notes may be found equally useful. The section of country covered by these notes is a far cry from the Nilghris, and the fishing differs considerably from the lovely trout-fishing of those fascinating hills.

These notes do not in any way pretend to be exhaustive or learned, but are merely a series of jottings, which may be useful to any of those of the Corps or other branches of the Service who find themselves stationed in or near the U.P., and who have had the foresight to bring their rods and tackle with them, and may save them waste of valuable hours.

It is the habit usually in any dissertation on fishing, or even in the smallest of published notes, to commence by giving an exhaustive account of rods and tackle, and the writer's pet theories are often heavily exploited, or some special rod-maker's fancy gadgets are described and illustrated.

It is not my intention to follow this example; but I trust that any

[1] The chief interest in Milligan's book is the account of the eccentric Irish Assistant Surgeon, Maurice Quin of the 31st, whom James Grant probably had in mind when he described Dr. Quin in the "Romance of War." Quin was certainly not typical of the army surgeon of that date, who was more usually a sober-minded Scotsman.

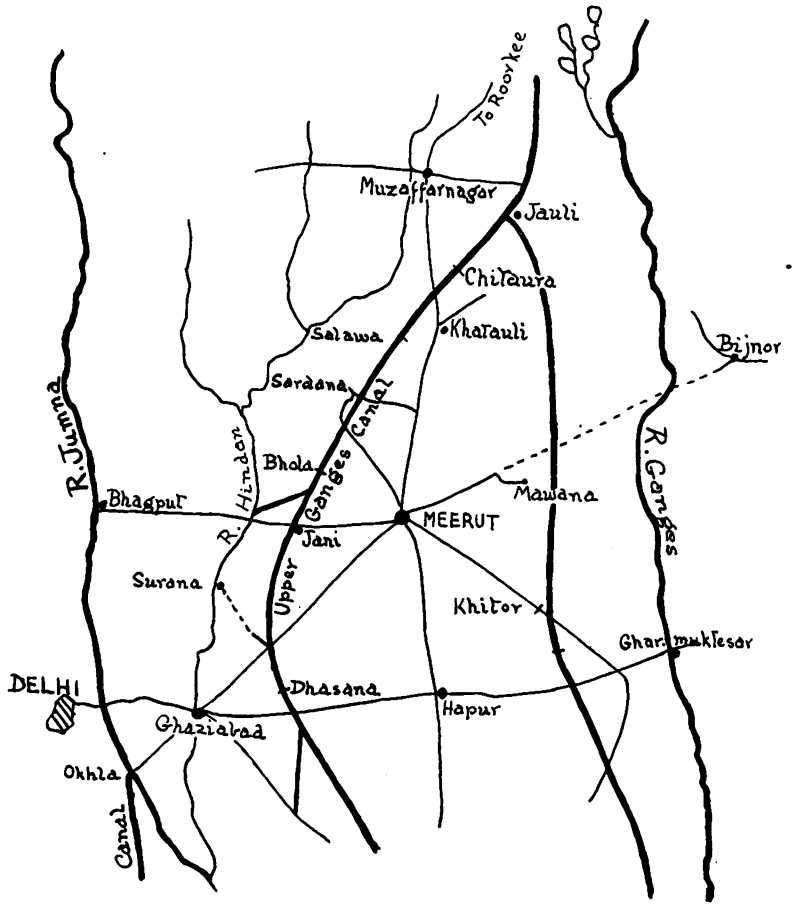
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patient reader will forgive me if, at times, some special device, which has been found successful, is minutely described in order to assist those, if any, who wish to gain a second-hand experience from these notes.

The notes cover chiefly such fishing as can be obtained when stationed at Meerut and Ranikhet, and touring or on leave in the neighbouring districts.

Meerut.

A pleasant enough station, with many occupations and distractions, but it cannot boast of any river other than small local nullahs and ponds, from



Map 1.—Sketch map of Meerut area.

which the local professional extracts fish for the market by means of nets and patience.

The Meerut plain is, however, irrigated by the Upper Ganges Canal, the main portion of which passes some 10 miles west of the cantonment; and a branch some 15 miles to the east between the town and the Ganges, crossing the Garhmukhtesar road just beyond the village of

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Khitor. Fishing in this portion is on the same lines as in the main canal, but personal experience on one occasion only, produced a blank day at a fall south of the road.

The main canal comes down from the headworks at Hardwar, through the cantonment of Roorkee, past Muzzafarnagar, crosses under the Meerut-Roorkee road at Khitauli, 18 miles out, and runs south within 7 miles of Meerut, crossing under the Meerut-Sardana road 7 miles out and the Meerut-Bhagput road 10 miles out.

Further south it crosses under the Meerut-Delhi road 20 miles out, and again under the Delhi-Garhmukhtesar road near Dharsana some 14 miles from Delhi, or 5 miles south of the Delhi-Meerut road bridge.

These canals form a most excellent substitute for rivers, and some very good fishing may be obtained from them. The canals have a steady, fairly rapid flow, which is augmented at intervals of about 5 to 8 miles by falls of about 10 feet. At the falls a side cut and lock allow the passage of barges, and in these side cuts often good fishing can be obtained.

Throughout the Roorkee-Meerut sections each canal has a canal road along the left or east bank. This road is private and is protected by gates at various intervals. A pass or permission to use this road has to be obtained from the Canal authorities. In the Roorkee division a key may be obtained from the Executive Engineer for a deposit of Rs. 100, which is refunded on return of the key. It is no use trying to get through without this key, because some of the gates are double locked now, owing to malpractice of certain sections of the public. For the Meerut section a pass is usually readily granted by the Executive Engineer. For the Dhasana section there are no gates but a pass should be obtained.

The falls or weirs are shown on Map 1. The best or easiest to fish from Meerut are:—

(1) Bhola fall; where the Meerut city water supply is taken in. Proceed out along the Bhagput road and turn up the canal from the road bridge.

(2) Salawa fall; a very good pool. Proceed up the Roorkee road to the 9th milestone; turn left along the north Sardana road and then up the canal about 5 miles.

There is an excellent side cut from a mill at this fall, in which good sport may be had below a small weir. My sons, aged 5 and 7, got rohu of $1\frac{1}{2}$, $3\frac{3}{4}$, $2\frac{1}{2}$ and 5 pounds respectively in a short afternoon's fishing at this spot.

(3) Chitaura fall; about 4 miles above the Khitauli Bridge. Reached by the Roorkee road to Khitauli and then up the canal.

(4) Dhasana fall; a big and very popular fall, which frequently has three or four fishermen of a Sunday. Easily reached by turning off down the canal from the Delhi road.

Miss Jackson's jheel is on the west of this fall. This teems with duck, but permission to shoot must be obtained from Miss Jackson.

The fish in the canals are of many kinds, but for the fun of mahseer

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fishing the falls or the runs below the bridges are the only really likely spots. The mahseer are usually in excellent condition when the water is fishable and are always capable of giving good sport. The water is frequently rather muddy, especially when the canals are first opened, but if a visibility of 6 inches is found it should be possible to get fish. However, the clearer the water the better are the chances. The clearness of the water depends largely on the condition of the Ganges and also on the amount of irrigation being done. The best times are probably in November, before the weather becomes too cold, but better still in March or early April.

Good strong tackle is advisable because, although the fish are not usually large, up to 2 pounds, there is often difficulty in following the fish down the run at first.

The fishing areas are just below the white water in the swirl of the pool. The pools are formed by a series of steps below the actual fall, off which the water surges into a large basin. Below the basin is a narrow run of about 300 to 400 yards, after which the canal resumes its normal run.

The weir is supported by two or three buttresses which extend out into the pool, and it is here the difficulty arises, because a fisherman standing on one of these has to hold on to his fish until he can get up on the weir bridge and round on to the bank. Beware how you let your spinner sink, because the bottom of the pool and fall-steps are composed of huge wire crates filled with stones. If your trace gets round a wire, there is no chance of getting it again.

Method of Fishing.—Spinning is essentially the method for mahseer in these pools. Some people use spoon, or various types of artificial minnow ; others prefer a fresh chilwa on a Rivett-Carnac tackle or some similar type of mount. Personally, I always use the bent formalin-chilwa with a single triangle hook on a wire trace passed away from the vent out through the mouth. If the chilwa is properly prepared and correctly bent, one will last many hours of fishing. It has just the action of an injured living fish. It is bright and attractive. It does not sink of its own accord. It is less likely to foul snags of any kind ; and finally, if hung up and lost, the loss is only one triangle hook, a portion of trace and a cheap chilwa. It is the cheapest type of spinner. I always use this type of spinner wherever I can, as it is so handy and it obviates the long wait for the catching of fresh chilwa or the necessity of taking a supply of fresh ones out each time. The method of making them is as follows :—

(1) Get half to one pound of fresh good-conditioned chilwa. Place them in a large soup plate in a position practically straight until near the tail which is kinked round at about 45° to the body.

(2) Place the selected ten or twelve side by side in this position. I usually place them alternately, belly up and back up, so that half of my baits spin in the opposite direction to the other half and the use of several

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alternate spinners in a day's fishing prevents having the line twisted always in the same direction.

(3) Over the chilwa pour two or three tablespoons of concentrated formalin, taking care that all the surfaces of each fish are wetted with it. Allow to stand five to ten minutes. This ensures the setting of each fish.

(4) Fill up with ordinary water to cover all fish and leave twenty-four hours.

(5) Pour off the formalin solution and cover with fresh water and add two tablespoons of powdered coarse salt; fill up with water and leave forty-eight hours.

(6) Pour off solution. Pack baits into cigarette tin and sprinkle with more powdered common salt.

(7) They can be kept like this for many months. The tins tend to rust and may discolour the fish after a time.

(8) For use: pass a wire snood mounted with a single triangle, by means of a baiting needle, up through the vent; bring the wire out through the mouth. Draw the hook up flush to the vent. Close the mouth with a couple of thin thread stitches. I never use weights inside the fish. I have never yet found the hook fail to hook a fish which had really gone for and captured the bait. The size of the triangle should vary with the size of the bait.

Use a good deep-keeled anti-kink lead on your line above your trace. With this type of bait I have found that if a fish really means business at all, he will practically always go for the bait and, if he actually snatches at it, provided a proper sized triangle has been used, hooking of the fish almost invariably results. I also find that, with a good anti-kink lead and no weight in the fish itself, a much more natural wobbling spin is given to the bait. This can readily be watched in any heavy run, wherein it is seen that the lead remains steady and the bait appears to make a continual series of wild darts from one side to the other.

I have sometimes found, even in the clearest of water, that whereas with any other type of bait the mahseer will merely come up to have a look at the offered bait, with this natural wobbler, if he comes, the apparent struggles of the wounded fish are too much for him to resist the temptation.

Besides mahseer fishing, there are many other types of fish in these canals, which require a certain amount of skill and patience. The fishing is carried out by the same methods as for tank angling, and fish such as rohu and kala banse require some pretty quick striking.

The spots which have been recommended to me or I have tried are: (1) the side cut and sand banks below the main run at Salawa; (2) the sand banks below Dhasana fall; (3) the cut and banks below Bhola fall; (4) the wharf above the bridge on the Meerut-Sardana road; (5) the escape outfall west of Bhola into the Hindan River. This last spot, I am told, gives very good fishing indeed when the escape has been recently opened.

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At these times spinning may produce results; but the usual bait is either some atta mixture or any kind of meat bait. I have seen some fine fish caught from this spot. In the Hindan River itself may be had the usual type of bottom fishing, either with atta, meat or dead fish at almost any spot. Just below the bridge of boats on the Meerut-Bhagput road there are usually some big fish in evidence.

About five miles down stream from this bridge there is an excellent piece of river when the water runs deep past several steep cliffs. This is at a village next above the village of Surana, and can be reached by kuchha tracks in a Ford or Chevrolet across country for about five miles by leaving the main road half a mile east of the bridge over the Hindan. It is a delightful spot where we have had many a picnic-shoot. The shooting includes black buck, chinkara, partridges, black and grey, duck of all kinds, snipe, quail, pigeon and mugger, and yarns about hyenas and wolves are included.

Here I have watched a local fisherman catch some fish with dead bait and he assured me he got fish of 1½ to 2 maunds weight (100 to 150 pounds) on the same tackle. Looking at his tackle I could well believe him. The water abounds also with turtles.

Delhi.

There is only one spot near here of which much can be said, and that is at Okhla. Here is the dam for the take-off of the Agra or Lower Jumna canal, and the fishing here is described in various books, such as "The Mighty Mahseer," and "The Rod in India."

Unfortunately for the fisherman stationed in Delhi, the locality is now a fashionable evening resort for all the wealthy inhabitants of the whole of Delhi, and anything up to 300 cars will be found parked round the head of the canal, and fishing has to be conducted before and amongst a crowd resembling closely a bank holiday crush. However, as the hot weather comes on, the crowd is not so great, but there always appear to be at least twenty to twenty-five fishermen to take the best spots available. Okhla is about eight miles from Delhi; proceed along the Muttra road and take the first turn to the left when clear of the outskirts of Delhi itself.

There is an enormous variety of fish to be caught here, though personal experience has been limited to goonch. These grow very large, and tales are told of monsters of over two maunds (160 pounds).

Spinning, fly fishing for butchwa, atta baits and green weed are all reliable methods for various types of fish; but baiting with a bunch of live chilwa is the method universally employed by the local semi-professional.

The method is of interest from two points:—

(1) The method of procuring chilwa. An empty basket is let down from the weir on a string so that it hangs just clear at the side of the rush of water spouting through one of the weir sluices, and about four to six inches above the top of the relatively smooth white water of the back eddy.

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The basket is filled in about two to ten minutes by chilwa which are jumping up the sides of the rush of water.

It is amazing to see the empty basket filling of its own accord.

(2) The method of using the chilwa. On a single large hook, some two inches long by half inch breadth at the curve, six to ten live chilwa are strung either through their mouths or tails. The bunch is gently cast out and allowed to swing down with the current, being kept up near the top by gentle tension. Many silund are caught this way, and one will see the local experts with a fish on every eight to ten minutes. When caught, the fish, varying from five to twenty-five pounds, are strung on to a stout cord and kept alive in the water until fishing is finished.

From February to May good fishing can be had, depending on the amount of water coming through, and also during the monsoon, after the water has run clear, until it gets too low in October.

Dehra Dun and Chakrata.

Dehra Dun can well be called the fisherman's paradise. But alas! it is practically an I.M.S. preserve as far as the medical service is concerned. However, if the newly-opened British wing to the hospital continues, then one at least of the Corps has a chance of enjoying the good things.

From Chakrata, and perhaps from Landour, too, it is possible to get a taste of the delights of the Dehra Dun Fishing Association. But the long trip down the hill and up again, not to mention a very heavy share of work in those two salubrious spots, does not allow of that free and easy daily access to the fishing which the superior personnel of the I.M.H. Dehra Dun appear to enjoy.

A car is essential, either your own or a loan from a friend, preferably a brother angler.

Sketch map No. 2 shows the general idea of the fishing grounds. It will be seen that there are really two areas. West to the Jumna and its tributaries, and east to the Ganges and its streams, the Song and the Suswa.

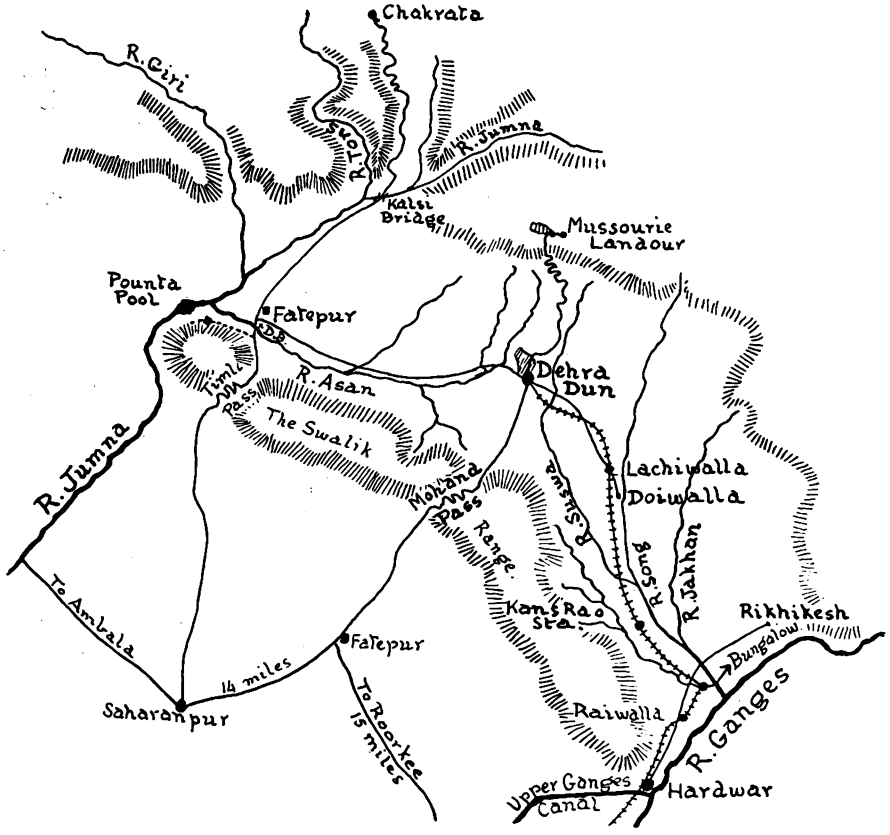
The fishing consists of big stuff in the Jumna and Ganges, particularly at the junctions of such streams as the Chakrata stream, the Tons, the Giri and the Asan with the Jumna, and of the Song and Suswa with the Ganges. The type is chiefly mahseer, but goonch may appear, too, and the method is almost exclusively spinning with spoon or chilwa. In the smaller streams the fishing is almost entirely mahseer, and murral and barillus bola (Indian trout) up to five to ten pounds. These smaller streams are almost entirely delightful gravel streams, with clear runs and pools flowing through fine game jungle country.

Practically all the water is now leased and preserved by the Dehra Dun Fishing Association. The Secretary lives at the Dehra Dun Club and the annual subscription, limited to 100 members, is Rs. 25 each. Membership

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is essential, though day tickets may be obtained, because the forest roads leading to the fishing are now controlled by locked gates of which the keys can only be obtained through the Association.

From Chakrata free fishing may be had above and below the Kalsi bridge, and I have frequently stopped here on my way down on tour for a couple of hours' fishing. There is a good pool under the bridge, provided log-running operations have not frightened all the fish away, and about



Map 2.—Sketch map of Dehra Dun, showing fishing localities.

200 yards below the bridge is an excellent long, flat pool where I have got decent fish.

A mile up stream opposite the take-off of the irrigation canal is a good pool against the cliff on the right bank.

Just where the small Chakrata stream joins the Jumna is a spot where one mahseer can nearly always be found, however dirty the water. The spot is at the point near the Asoka pillar, where the coloured and clean water meet. I have never tried the Tons junction. I understand the Tons water is too cold for mahseer until late in the season.

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The Asan-Jumna Junction.

This is a very favourite spot for those who fish and those who catch fish. It is reached by a forest road which opens off the Chakrata-Saharanpur road, about one mile south of the bridge over the Asan. A key is essential. About four miles along this forest road is a forest guard's hut. Leave the car here, call for the fishing guard, and walk the half mile to the water.

The junction of course changes with each monsoon, but for several years there has been an extensive parallel flow, the warm clear waters of the Asan running for several hundred yards with the cold or dirty Jumna before finally mixing. It is along this stretch that fishermen are dotted every forty yards on a Sunday in April and May. Fishing is with heavy spinning, and here again I have nearly always used the bent formalin-chilwa. Some very good fish have been caught here recently, chiefly by Mr. Quarry, an old hand, and by Major Grant, I.M.S.

There is a good story of a lady who was fishing here last summer, with good new strong tackle and 150 yards of new best ——'s line with some backing as well. She got into a very heavy fish which she could not hold, play it how she would, and which gradually took more and more line. Suddenly there was a thin plaintive wail, "Oh, my line's gone"; she had forgotten to tie her line to her reel and the whole new expensive outfit went off down the river.

The best times of the day appear to be in the morning or an hour or two before sunset, but this rather depends on the weather and the months. March, April and May appear to give the best bags. If there is a wind blowing the fish cease to take an interest.

There is a small grass hut built by the Association on the bank at the junction where one can shelter from the sun or pass a night. About a mile below the junction is the famous Pounta pool, said to hold monsters, some of which are fed from the temple on the far bank. I believe that a boat is necessary to fish this pool properly.

The Asan.

This is a clear, gravelly stream flowing through meadow land and has some beautiful runs and pools. It is fishable for many miles up, but the best parts are from the road bridge down to the junction. Part of this has only recently been open to members of the Association. There is a P.W.D. bungalow on the road by the bridge. Fishing in this part is either by fly or fly-spoon. The latter is often extremely effective and the chances of a good murral or trout are greater than with a fly. But with either a very fine day's or evening's sport can be had, with perhaps 10-20-30 sizeable mahseer up to two or three pounds as the result. The best fly is the yellow spider. To my mind the trout give the best sport for their size.

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They are almost always found on the flat sandy shallow towards the lower end of the pool.

As the monsoon comes on very big fish run up these small streams, the Asan, the Song, and Suswa. In fact, a few years ago a forty-two pound female fish was captured by recruits of the 9th Gurkhas right up in the Tons, a branch of the Asan, in their own regimental lines in Dehra Dun.

The Song and Suswa.

These lie to the south-east of Dehra and are beautiful gravel streams flowing through jungle blocks, where anything from an elephant, or a tiger, to a python may be met.

The way is by road to near Lachiwalla, turning off before the railway crossing to the right through forest roads. It would be difficult to find the way without local aid and a key is essential now. The best part to go for is along the forest roads to 1½ miles beyond Kans Rao station. Leave the car at a small stream one mile beyond the station and cut straight through the jungle to the north to meet the Song. From here down to the junction with the Ganges there is a continuous chain of pools and runs. All of these hold fish, particularly when the fish are beginning to move up before the monsoon.

In the monsoon period, in a break in the rains, good fish can be got up to and above Lachiwalla, but the forest roads are closed and a journey by train is necessary for Kans Rao at this period. Very good bags can be got in the Kans Rao section. I have recollections of a delightful day with Major Grant, when Colonel Fry, the A.D.M.S., and Grant and I got seventy-five sizeable fish in the day (all were not kept).

Although the Song changes its course practically every monsoon, there is one pool worth describing. That is the Jakhan pool. The Song may be warm and clear and meets the Jakhan stream, which comes out of the trees bringing seemingly ice-cold clear water from the dense jungle. A magnificent pool with a deep run under the high jungle bank gives ideal fishing. Thirty-three fish from this one pool was, I think, the score for the day mentioned above.

The lower part of the Song and that of the Suswa can also be reached from Hardwar (or Roorkee) by the road from Hardwar to Raiwalla on the Rikhikesh road. Magnificent water can be got at in this section and the association has a fishing bungalow close to the river, near the road bridge, just east of the Hardwar-Rikhikesh railway. A stay at this bungalow, which is provided with crockery, etc., will give anyone a magnificent week-end fishing.

Note.—It can be amazingly hot on the open gravelly bed of the Song near the junction.

The junction itself has been very poor for some years, as the Song and the Suswa join and run in at right angles to the Ganges, giving very little opportunity of fishing the mixing waters.

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The Suswa is a smaller, but very beautiful, jungle stream which will give good sport when the other waters are dirty with flood.

HARDWAR.

Much has been written about the fishing here; but, having no personal experience, I will only mention that fishing in or near the sacred pool is forbidden, and fishing actually from the works of the canal dam is not allowed; but this difficulty can be got over by fishing from the bank and rock immediately below the works. Most wonderful fishing can be got here by those who can obtain permission. The sacred pool is a wonderful sight with a solid carpet of mahseer from five to fifty pounds, which surge up in a struggling mass when atta or grain is thrown in.

(To be continued.)

Current Literature.

MACY, ICIE G. & OUTHOUSE, JULIA. **Breast Milk—a Variable Food.** *J. Amer. Dietetic Ass.* 1928, v. 4, 9-14. [9 refs.] [Nutrition Research Labs. of the Merrill-Palmer School and Children's Hosp., Michigan, Detroit.]

The authors deal briefly with studies by themselves and others on factors affecting the quantity and composition of human milk. Psychic factors play an important rôle in human milk production, and examples are quoted of temporary reduction in the quantity of milk secreted, caused by fright or anxiety. A reduction in liquid intake, failure to empty the breasts completely at given intervals, and overwork all tend to lower the quantity produced. The vitamin A content of average human milk is such that 2 to 3 c.c. suffice to supply the daily growth requirements of rats. Subnormal variations in the quantity of this vitamin frequently occur. The vitamin content of the diet of the mother appears largely to determine the content of vitamin in the milk produced. For example, the milk from a lactating woman whose diet consisted largely of tea and toast did not contain sufficient vitamin A to maintain rats when fed as the sole source of vitamin A in the diet. Another example is the fact that the Oriental women with beriberi produce milk deficient in vitamin B, with the inevitable result of beriberi in their infants. It is considered inadvisable to depend upon milk to supply babies with sufficient vitamins C and D, and supplementary sources of these vitamins should be included in the diet.

DOUGLAS C. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 4, No. 10.

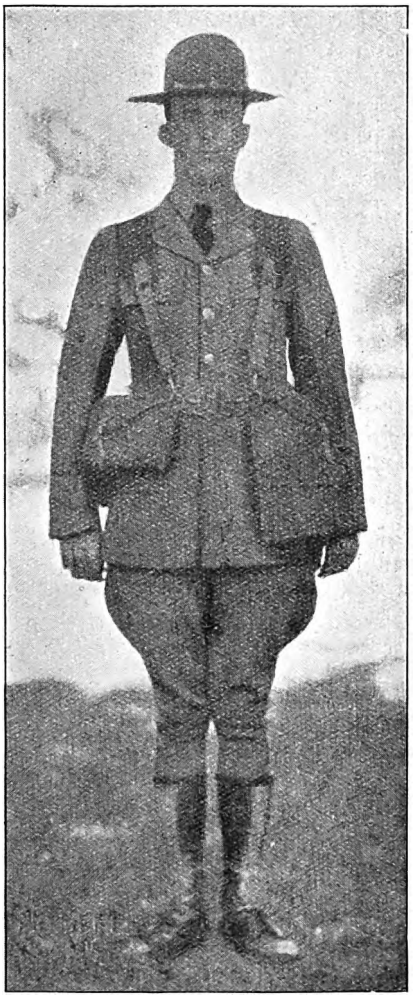
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FLETCHER, Major J. P., U.S. Army. **Research Development of Field Medical Equipment.** *Military Surgeon.* December, 1929. Pp. 814-841.

The author states that adequate first-aid and rapid evacuation depend "on proper equipment to meet the situation, which in battle means



The Medical Soldier wearing new individual equipment, showing litter sling attached to suspender.



The Medical Soldier wearing new individual equipment. One pouch is extended to the "emergency" position.

equipment possessing utility, durability and above all transportability." The Medical Department which is responsible for such equipment has organized a research development laboratory to produce it.

The first project undertaken was a revision of the first-aid dressings and two standard types have been produced. The small "first-aid

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packet" consists of a gauze-covered cotton pad, 5 inches by 7 inches, attached to a four-tail bandage." The large first-aid dressing intended for shell-wounds is "a gauze-covered cotton pad approximately $11\frac{3}{4}$ inches square backed up with unbleached muslin, equipped with four bandage tails and four safety pins." The pad contains 3 ounces of cotton. These two new dressings will replace the five types used during the World War.

The individual equipment was next revised and a waterproof canvas pouch was so designed that in an emergency it could be expanded to double its normal capacity. The pouch may be suspended from a Sam Browne belt, or from the shoulder by means of a strap, it may also be attached to a saddle. Two pouches "may be supported from the shoulder by a suspender-like device so that they form a loose belt at the waist."

The two pouches carried on either side of the middle line in front at about the level of the waist and supported by the suspender are very comfortable. The individual equipment also includes two webbing straps, which may be attached to the suspender yoke and provide litter (stretcher) slings adjusted to the length of the bearer's arms. By means of these slings and the yoke the weight of the stretcher is borne by the back and shoulders and not on the spinous process of the seventh cervical vertebra, as in the old pattern sling.

The medical equipment of a battalion of infantry was then studied and a special container was designed to carry dressings calculated on 20 per cent casualties, less 80 per cent of the dressings carried by the medical detachment with the battalion. The number of dressings so calculated was then doubled. The container, or trunk was made of "three-ply veneer to which was studded 24-gauge galvanized steel," and was so strong that when carrying a weight of 250 pounds it could be dropped 16 feet without any damage resulting. Drawers were provided in this trunk. Two trunks were required for dressings and when they were stood on end an excellent dressing table was formed by means of a "table board swung up from the lid."

A third trunk containing drugs and instruments was provided and when the drawers were removed the container stood on end formed with one of the other two trunks a stand for a stretcher at a convenient height for dressing the patient. Food, kettles and a stove were carried in another trunk. These four trunks formed the basis of the battalion equipment. Multiples of the trunks were used for the equipment of a Collecting Company and of a Hospital Company.

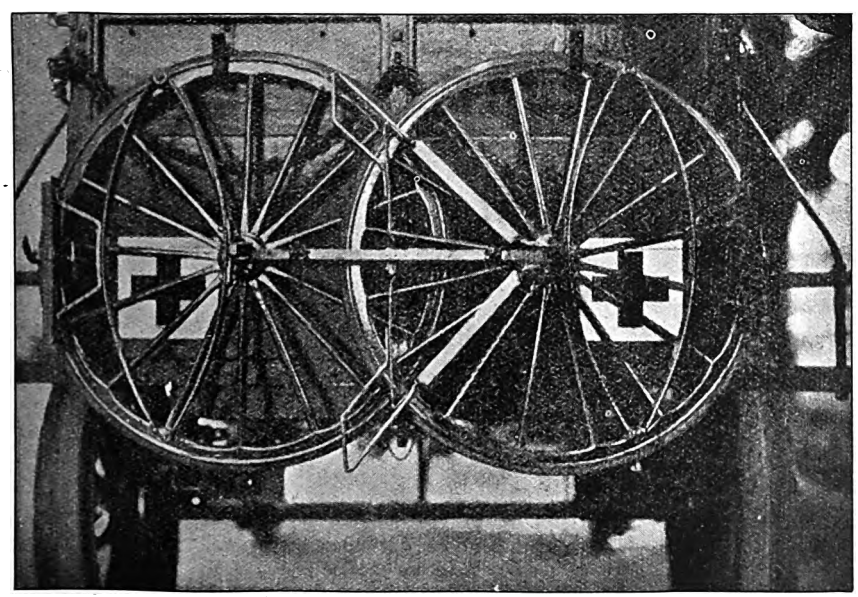
During the war a field stretcher carrier, mounted on pneumatic-tyred motor-cycle wheels, capable of carrying two stretchers was used. But practical experience showed that it was too heavy to be handled by man-power.

A new two-wheeled carrier, weighing only 70 pounds, has been designed. It is mounted on small rubber-tyred wheels and can be folded with the wheels parallel to the axle. When thus folded it is only 8 inches thick

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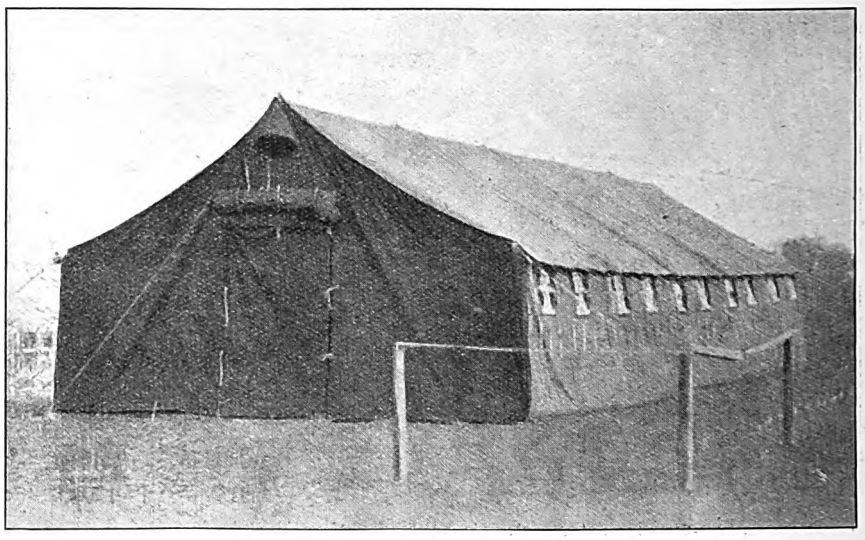
Collapsible two-wheeled litter cart. Cart, litter, and patient can be lifted across ditch without delay.



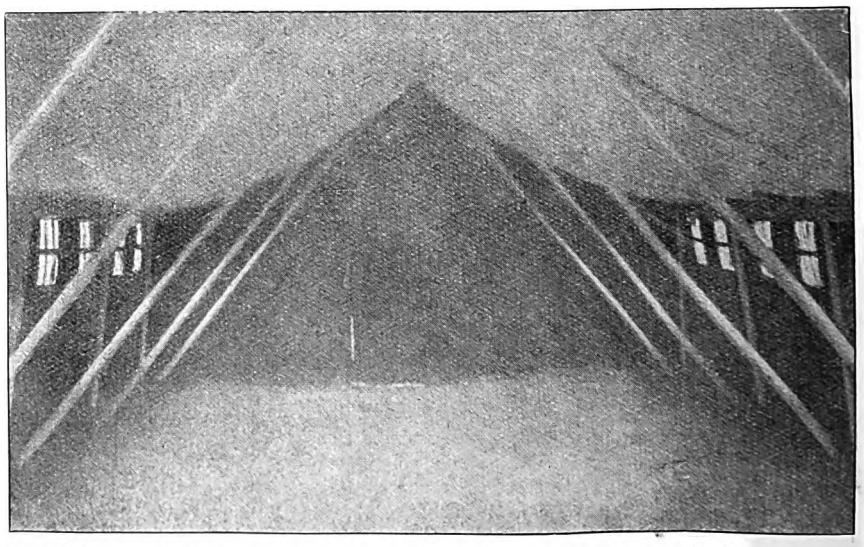
The collapsible two-wheel litter cart carried on tailgate of medical combat wagon (animal-drawn ambulance Model 1924).

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and can be hung on the tailboard of any vehicle. Two bearers can lift the patient, stretcher and carrier over any ditches which necessitated the patient being removed from the old carrier.



Tent, ward, hospital, heavy type (for surgical and evacuation hospitals). Model shown is fifty feet long by eighteen feet wide. Note ventilator hood over front door. This hood covers an opening into the space between the roof and the ceiling liner.



Tent, ward, hospital, heavy type. (For surgical and evacuation hospitals.) Note windows and ceiling liner; also absence of centre poles.

During the war a motor ambulance body capable of carrying four loaded stretchers was employed. On the chassis of this ambulance a body has been built which can carry six stretchers and is only $1\frac{11}{16}$ inches wider

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than the old ambulance and is 88 pounds lighter. The centre post and rails have been eliminated so that the body is clear and can carry twelve seated passengers.

A light motor ambulance (Chevrolet) has also been designed to carry four loaded stretchers. It has balloon tyres, shock absorbers, and is so light that fourteen men can lift it.

With the object of carrying medical personnel a regimental cart has been built. Mounted on a rubber-tyred trailer chassis it can be drawn by animals or trailed behind a motor. When loaded with the equipment which only occupies half the height of the sides, braces are placed across the vehicle on which the side walls fold down and two side seats, carrying twelve men, are formed. Without the equipment the vehicle can be used as an ambulance and will carry four loaded stretchers. It is proposed as a substitute for the present animal-drawn ambulance.

In connection with the Air Corps a new airplane stretcher (litter) has been constructed, which will be the standard stretcher for use with airplanes, in trench warfare and on board ship.

A new hospital ward tent has been devised for use in surgical and evacuation hospitals. The tent is light-proof and waterproof and is designed to eliminate centre poles. It has windows with awning curtains, and may have screens. Being made of waterproof duck it can be easily heated in cold weather. It is cool in hot weather as there is a lining at the ceiling which produces an insulating air space at the top of the tent. The tent is constructed in units 10 feet long, so that it may be erected "with a minimum length of 20 feet, or a maximum of 20 feet plus any desired multiple of 10 feet."

Reviews.

THE ROYAL AIR FORCE QUARTERLY. Vol. I. No. 1, January, 1930. Edited by Squadron-Leader C. G. Burge, O.B.E., R.A.F. (retired). London: Gale and Polden, Ltd. Pp. xlviii + 234. Price 7s. 6d. net.

This new periodical appears to be of a semi-official nature. Its first appeal will be to executive officers of the R.A.F., but it is also intended to cater for all those interested in civil aeronautics. The contents will embrace all R.A.F. professional subjects, articles on technical developments, Imperial and foreign questions, experiences in the Service, etc.

The first issue is a high-class production in every way and contains a large number of illustrations including two colour plates and four photogravures.

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THE TREATMENT OF VARICOSE VEINS OF THE LOWER EXTREMITIES BY INJECTIONS. By T. Henry Treves-Barber, M.D., B.Sc. Bristol: J. Wright and Sons. 1929. Pp. 120. Price 6s.

This is a work that can be confidently recommended to all who are anxious to become familar with the technique of the treatment of varicose veins by sclerosing solutions.

In a small book the author has managed to give ample detail of the methods advocated, and any medical officer should now be capable of giving the treatment with safety and success. J. H. M. F.

ACUTE INFECTIOUS DISEASES. A Handbook for Practitioners and Students. By J. D. Rolleston, M.A., M.D. Second Edition. London: William Heinemann (Medical Books), Ltd. 1929. 8vo, pp. viii + 419. 15s. net.

In producing the new edition of this most popular work, the author has wisely contented himself with a revision of the old, bringing in any pertinent additions to our knowledge since the last was published four and a half years ago. Additions and alterations have been made mostly in the chapters on diphtheria, typhoid fever, scarlet fever, measles, smallpox, and vaccinia. With these and the completion of the lists of references the work has been brought thoroughly up to date.

There is no change of form in the book, which remains an excellent handbook on such diseases as are mainly or exclusively treated in isolation hospitals. It will continue to be one of the most valuable and widely read of the smaller volumes on the subject.

INSECTS, TICKS, MITES AND VENOMOUS ANIMALS OF MEDICAL AND VETERINARY IMPORTANCE. Part I, Medical. By W. S. Patton, M.B., and A. M. Evans, D.Sc. Pp. x + 785. Liverpool School of Tropical Medicine. 20s. post paid.

For years past a comprehensive treatise on medical entomology has been sorely needed. "Patton and Cragg" served generations of students as a trusty and revered guide, but Age, with his stealing step, hath clawed it in his clutch. Its successor is, in the main, moulded on a different plan. The fundamental subject of morphology is dealt with, as before, in admirable detail in an introductory section of 150 pages which the authors rightly consider the most important part of the book. The teaching on systematic entomology is arranged in a novel fashion. It is based on the course of instruction at the Liverpool School of Tropical Medicine, and the subject matter is divided up and treated in accordance with the daily routine adopted there. The class-work, however, is amplified to help those whose vision is not narrowed to the requirements of the D.T.M., and anyone who wishes to make a study of some special groups of insects will find everything here to set him on his way. At the same time the unambitious students are not forgotten, and these can gain the desired minimum of

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knowledge without troubling further. Especially deserving of mention are the very complete summaries of present knowledge as regards the transmission of specific diseases by insects and arachnids.

There are over 400 illustrations, mostly original, and their excellence testifies to the infinitude of trouble that has gone to their production. This outstanding feature of the book, apart altogether from its other merits, makes the purchase price, 20s., nothing short of amazing.

The reviewer feels that no lengthy notice of this remarkable volume is required; it speaks for itself and will attain its appropriate status as a classic without the need of one melodious puff.

CLINICAL METHODS. By Robert Hutchison, M.D., F.R.C.P., and Donald Hunter, M.D., F.R.C.P. Ninth Edition. London: Cassell and Co., Ltd. 1929. Pp xii + 684. 18 colour and 2 half-tone plates, and 152 figures in the text. 12s. 6d. net.

In preparing this new edition, Dr. Hutchison has been fortunate in securing the co-operation of Dr. Hunter, with whose help the whole of the text has been thoroughly revised.

Out-of-date matter has been eliminated, and much new introduced without any increase in the size of the volume. The chief changes are to be found in the chapters on the nervous system, the examination of pathological fluids and on bacteriological investigations; the two former have been largely, and the last entirely, rewritten. Many minor alterations have been made in the other chapters. New plates are those of reticulocytes and the schistosomata.

On such a volume as this, whose predecessors are in the hands of almost every medical man in this country, comment is needless. As it is five years since the last edition was published, the necessity for buying the new one will be apparent.

THE EXTRA PHARMACOPŒIA OF MARTINDALE AND WESTCOTT. Revised by W. Harrison Martindale, Ph.D., Ph.Ch., F.C.S. Nineteenth Edition. Vol. II. Pp. xxxviii + 759. London: H. K. Lewis and Co., Ltd. 1929. Price 22s. 6d.

This is the companion volume to the new edition of Volume I, which was published a year ago, and has likewise been revised and thoroughly brought up to date. Only those who have studied this volume can realize the mass of information it contains, and any attempt to indicate its scope briefly must fail to do it justice. One is lost in admiration of the painstaking care and thoroughness with which it has been compiled and kept up to date.

In a preface of 18 pages, the revisor draws attention to the new features in this edition. These consist largely of new pharmacological investigations, processes of treatment and diagnostic methods, and make a formidable list, indicative of the amount of experimental research now being carried out in many fields.

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One cannot but agree with the opinion expressed by Mr. Martindale that many new remedies are advocated without sufficient proof of utility, but in spite of the keen competition of modern remedies it is believed that the old and well-tried friends of the general practitioner are prescribed to-day as extensively as ever they were in the past.

To pick out some of the more interesting and instructive sections of the book, one may mention those on arsenic, iodine, nutrimenta, including the calorie value of foods and vitamins, organo-therapy, iontophoresis, radiology and radium. The analysis of body fluids, secretions and excretions, are very adequately dealt with, and at some considerable length, as also is the analysis of water, milk and foods.

Bacteriological and clinical notes occupy 112 pages, and if any criticism were to be offered it would be that much of this section appears to go beyond the sphere of pharmacology, and from this point of view might with advantage be omitted.

MAPS OF IRAQ WITH NOTES FOR VISITORS. London: Edward Stanford. Revised and enlarged edition. 1929. Pp. 34. Price in England 6s. 6d.; in Iraq Rs. 4.

The issue of a new edition of a guide-book of this description is indeed a sign of the times and a mark of progress so far as Iraq is concerned. It is an indication that more and more visitors are finding their way to a land of supreme archæological interest. The country is being opened up more and more every year. Roads are being made passable in every direction. When we talk of roads in Iraq it is necessary to visualize, in many instances, just a track across the plain or the desert; but when the traveller arrives at a donga or nullah, especially in wet weather, he will soon discover if he is on an official "road" by finding a concrete causeway over which his car may cross without very nearly disappearing into the soft mud. "Out of 4,800 miles of roads and tracks, only a score or two of miles are metalled roads, the remainder being earth roads; but in spite of this, it is possible to motor to almost every part of the country except the mountainous regions and the marshes." Whilst on the subject of roads, it is interesting to learn than an Iraq Automobile Association has come into being, whose goodwill it is to help visiting motorists.

The guide-book gives us very full information as to routes of entry into Iraq: from Beyrouth—Damascus—Rutbah: Aleppo—Mosul: Darbisiyah —Nisibin—Mosul. There is a full description of the overland route from India via Duzdab—Meshed—Tehran, although the map only shows the road west of Tehran. This India—Persia—Iraq route to Europe is as old as time, as over it passed the silk trade, until the sea routes were opened up by the Portuguese. But it is coming back to its own again with the security that has come to the land since Reza Shah has held power in Persia.

Map No. 8 is one of more than ordinary interest, because in no other

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work with which we are familiar is there to be found the old place names and the ancient sites superimposed on a modern map. One of the scales of this map, it may be added, is one inch to 1,000 years. The cities of Babylonia and Assyria are shown in black. That period lasted from about 3,100 to 539 B.C. The cities of the days of foreign rule are marked in red.

In the text or the preface to the map section we find a vast amount of information—historical, clear, concise, and to the point: economic, political, geographical and climatic, and finally a very fair bibliography of the subject.

As befits a Government publication, the book is very free from errors. On page 8, however, it is stated that Imperial Airways makes the journey from Cairo; this slip is corrected on page 11. As regards the arrangement of the *Notes*, the sequence does not always appeal, nor does it appear to be completely logical. Apart from a quibble of this sort, the work is a credit to its editors and will be found to be absolutely invaluable to visitors and tourists to the country, whether coming from the east or from the west.

It is to be noted the book is bound in a material that has been specially treated so as to render the work impervious to the ravages of insects.

D. S.

Notice.

CHADWICK TRUST.

A CLAUSE of the Chadwick Trust Scheme permits the presentation of a gold medal and prize of £100 once in every five years to the medical officer of the Navy, Army, or Air Force, who, in the opinion of the Medical Director-General of his arm of the Service shall have in the preceding five years specially assisted in promoting the health of the men of the force to which he is attached.

The latest recipient of this medal and prize is Surgeon-Captain Sheldon Francis Dudley, and the presentation was made by Sir James Crichton-Browne, a Chadwick Trustee, on February 13, 1930, before the first public lecture of the year.

The following lectures are announced:—

Thursday, March 20, 8 p.m., at the Institute of Mechanical Engineers, Westminster, Mrs. Margaret Fishenden, on "The Outlook for Smokeless Heating."

At Newcastle-on-Tyne, Professor A. E. Boycott, on "The Causes of Cancer."

Thursday, May 15, 8 p.m., at the Royal Sanitary Institute, Buckingham Palace Road, London, Edward Willis, on "The Collection and Disposal of Refuse."

Thursday, May 29, 5 p.m., at Chelsea Physic Garden, Arthur W. Hill, on "Cabbages and Kings."

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EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications, and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed "The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, War Office, Whitehall, London, S.W."

MANAGER'S NOTICES.

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VOL. LIV. APRIL, 1930. No. 4.

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Journal
of the
Royal Army Medical Corps.

Original Communications.

SOME NOTES ON DIVISIONAL MEDICAL UNITS IN MOBILE WARFARE.

BY LIEUTENANT-COLONEL G. A. K. H. REED,
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GENERAL CONSIDERATIONS.

So much has changed since the Great War in the organization of field ambulances and in the tactical dispositions of the fighting troops, that it is thought the following notes may be of use to those who have not had recent experience in field ambulance work.

In compiling these notes points are omitted as far as possible which are already exhaustively dealt with in "R.A.M.C. Training."

No attempt has been made to review the subject completely, and those who wish to study it fully are recommended to read many valuable articles which have appeared in the Journal from time to time—paras. 163-307 and 376-460 "R.A.M.C. Training" also refer to the subject.

Much that has been written must, however, be considered obsolete, as the conditions of warfare for which we are now preparing are in many respects different from those which obtained on most fronts in the Great War.

Reference will only be made to the field ambulance as at present constituted and to its normal functions, that is to say, the rapid collection of casualties from the regimental aid posts and their temporary treatment and concentration in a main dressing station until they can be evacuated by the motor ambulance convoy to a casualty clearing station.

As these notes are primarily intended for those with little or no previous

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experience of the work, it has been necessary to include a number of minor details and to adopt a somewhat dogmatic style on points about which there may be divergence of opinion.

Necessity for Mobility.

Under the conditions of mobile warfare a field ambulance is not the place for elaborate surgical procedure; its chief duty is to ensure the rapid clearing of the field of casualties. Treatment should be limited as far as possible to first aid, as even the M.D.S. may be required to move at short notice.

In mobile warfare a field ambulance must be kept mobile; its place is with the mobile troops with whom it should be in close touch at all times.

Owing to the increased use of mechanical appliances and the augmented fire power due to large numbers of mechanical weapons, the warfare of the future will be one of rapid movement; for the same reasons the frontages adopted now are much greater than they were a few years ago.[1]

Positions will be held in depth also, and a decision will be obtained by the successive attack and capture of local features of tactical importance rather than by the simultaneous advance of a line of storming infantry.

Airplanes will harass the line of march, so that casualties will be dispersed in groups over a very wide area and the work of the field ambulances made correspondingly difficult. Their mobility and elasticity will be tested to the full.

On the other hand, comparative difficulty of ammunition supply will prevent vast barrages and indiscriminate shelling of back areas.

Shelling of back areas will be confined to salient features such as villages near the line and important main and cross roads. It is therefore thought that the evacuation of casualties will not be interfered with by enemy action to such an extent as in sedentary warfare.

Importance of Close Liaison with the Fighting Troops, and Accurate Information.

These are essential, without them the medical service with a division cannot work effectively and delay in collection and evacuation will occur.

The scheme according to which the medical units will work must be carefully thought out after the fullest information has been obtained.

The following arrangements are suggested in order to promote close co-operation :—

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[1] An infantry battalion may occupy up to 1,000 yards of front and depth in an attack; in a defence these distances may be doubled. An infantry brigade will often occupy a frontage of 3 to 3½ miles, so that in a "normal" formation of two brigades in the line and one in reserve a division may cover a front of 7 miles.

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(*a*) *Administrative Liaison.*

It is suggested that: (1) The A.D.M.S. should live with the 1st Echelon of Divisional Headquarters; he will then be in close touch with "G" and "A" and will hear the earliest news of impending events.

(2) The A.D.M.S. should attend all conferences.

(3) He should have direct access to the G.O.C. as well as to the G.S.O. 1., as the handling of field ambulances is to a large extent a technical matter.

(4) During an action he should be in close touch with Divisional Headquarters.

(5) He or his D.A.D.M.S. should also be in close communication with the M.D.S., and have first-hand knowledge of the state of evacuation from A.D.S.'s. He should also be in touch with the M.A.C. and keep it notified of requirements.

(6) The position of the appropriate medical posts should appear in Unit Orders, i.e., (1) M.D.S. and W.W.C.P.'s, and in certain cases A.D.S.'s should be laid down in A.D.M.S.'s draft for insertion in Divisional Orders. (2) A.D.S.'s and W.W.C.P.'s (if formed) should also be in Brigade Orders and be repeated in Unit Orders.

All changes in position of these posts should be notified by the quickest possible means to all concerned. In addition to the signal service information may be sent, as far as medical units are concerned, by returning stretcher-bearers or wounded in motor ambulances, and by the field ambulance despatch riders. It would be an advantage if medical posts were connected by wireless or telephone and had expert signallers attached to them.

(*b*) *Liaison between Field Ambulances and Infantry Brigades.*

As noted before, the wide frontages on which troops work make centralization of medical control in front areas an extremely difficult if not impossible task during rapid movement.

Field ambulances or portions thereof will usually be affiliated to brigades and will generally make their own arrangements for the collection of wounded, forming C.P.'s and A.D.S.'s as required in consultation with the Brigadier and notifying their dispositions to the A.D.M.S.

The rôle of the A.D.M.S. during a mobile encounter is often necessarily limited to organizing preliminary arrangements, siting M.D.S.'s and W.W.C.P.'s, and supervising the evacuation of casualties from A.D.S.'s, also of course making new dispositions to meet emergencies. In certain cases he may, however, site the initial positions of A.D.S.'s, as in defensive warfare or when an attack is launched from a position which has been held for some time.

Close touch must therefore be kept between the O.C. field ambulance or field ambulance company and Brigade Headquarters if the medical arrangements are to work smoothly over the three to three and a half mile maximum frontage of an infantry brigade. The R.A.P. is, of course,

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sited close to Battalion Headquarters, and close touch maintained here also.

It is a well-known fact that during the rapidly changing fortunes of a mobile action the most useful information often comes from the front. Divisional Headquarters is itself dependent on this to a large extent once the force is committed. The A.D.M.S. is also dependent to a large extent on the information he receives from his field ambulances; he may often get information more quickly this way than via Divisional Headquarters.

The "affiliated" medical unit keeps in touch with Brigade Headquarters as follows:—

(1) Before the action is joined, two runners, one if possible a N.C.O., should be attached to Brigade Headquarters, their duty being to keep the O.C. field ambulance company informed of all happenings.

The O.C. field ambulance company should be with Brigade Headquarters until just before the action. He carries out in fact a medical reconnaissance.

The A.D.S. or C.P. should be sited as close to Brigade Headquarters (2nd Echelon) as possible.

(2) In a similar manner two stretcher-bearers from the field ambulance company should be attached to each R.M.O., their duty being to keep touch between the R.A.P.'s and the field ambulance stretcher-bearers. They make the first "carry" to the collecting (car) post or A.D.S., and then act as guides to the field ambulance squads. If the R.A.P. moves forward they will act similarly between the new and old R.A.P.

R.A.P.'s are generally sited close to the Battalion Headquarters, and the position of the latter is always known at Brigade Headquarters.

It sometimes happens, owing to rapid changes in the disposition of troops, as when (1) fresh units pass through those already in position, or when, (2) owing to the route of evacuation being changed it becomes necessary for the A.D.M.S. to move field ambulances to a flank where they may have to deal with additional troops, that liaison becomes extremely difficult. Every effort should, however, be made by companies and O.C. field ambulances to get into touch respectively with the new R.A.P.'s and headquarters of formations on the lines suggested above.

Reserve Medical Formations.

An ample reserve to meet unforeseen contingencies is necessary in mobile warfare. Units are very sparingly committed during the early stages of an action. In the case of the fighting troops a division usually has at least one brigade in reserve, each brigade in action has at least a battalion in reserve, and each battalion has a company in reserve, so that out of a total infantry strength of twelve battalions a strength equal to only some three or four battalions is usually engaged during the commencement of a fight.

The same principle must be observed in handling medical units. It is

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a difficult matter to forecast where casualties are likely to be heaviest. A unit which attacks a "feature" may be decimated, while others on its flanks may have very few casualties. It is obviously therefore incorrect to deploy all the units at once, as some may be standing idle whilst evacuation is held up in another sector for want of sufficient bearers and transport.

Another point to remember is that even in mobile warfare the unit which makes an attack, even if successful, is usually brought to a stand in 2,000 to 3,000 yards. Further advance is maintained by pushing up fresh units through the exhausted formations, and this system of leap-frogging, whether local or general, must be "taken care of" by appropriate medical formations held in readiness.

A "general" and "local" medical reserve is therefore necessary :—

(*a*) *The General Medical Reserve.*—At least one complete field ambulance should be held in reserve by the A.D.M.S. until the objectives have been gained and the enemy's counter-attack disposed of. This would be the unit corresponding to the reserve brigade.

(*b*) *Local Medical Reserve.*—Two field ambulance companies should be attached to each brigade in action; of these only one company should be deployed from the A.D.S. or C.P. at the commencement of the action. The second company should be kept in a position of readiness near the A.D.S., prepared to form new A.D.S.'s further forward and to help where casualties are heaviest.

It must be remembered that stretcher-bearers once deployed and in touch with R.A.P.'s, and A.D.S.'s once open, are difficult to extricate or divert. If, however, the single company is unable to deal with the casualties the bearers of the second must be used, even in the early stages of an action, theory notwithstanding. The situation would be easier if the number of bearers was brought up to its pre-war strength, or if some form of armoured cross-country ambulance wagon was used.

Some Remarks on A.D.S.'s.

A mistake sometimes made on staff rides by our officers is to site an A.D.S. too far forward. A line is given in Divisional Operation Orders as being held by the force; this line indicates the position held by the outposts. Battalion Headquarters and R.A.P.'s of the units concerned would be approximately 1,000 yards behind this line, and the A.D.S. should be about 1,000 yards further back still and beyond indirect machine-gun fire, unless cover is very good.[1]

Objection is taken to this by some, who say that the carry of a stretcher squad should not be more than 600 yards. The answer is that relay posts should be formed. Another point in this connexion is that the hand carry should be shortened as much as possible by bringing up wheels (wheeled stretchers, horsed ambulances, or light motor ambulances) in

[1] Indirect machine-gun fire can now be used up to 3,000 yards.

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advance of the A.D.S. to a point usually known as a "collecting" or "car" post, i.e., the spot where hand carriage gives place to wheels. An A.D.S. cannot function if it is liable to frequent moves. Owing to increased frontages and mobility, it is thought that these subsidiary posts will nearly always be required. A question sometimes asked and not always easy to answer is, "When should the A.D.S. be 'opened'?" If by "opening" is meant unpacking of all equipment and a detailed organizing as laid down in "R.A.M.C. Training," the only answer is, "When its opening can no longer be avoided." There is nothing more annoying and wasteful of energy than, having opened an A.D.S., to find that the infantry have advanced (or worse still, retired), leaving it out of touch with the casualties, and this has often happened in war time, especially in enclosed country.

It is necessary to lay down clearly the functions of an A.D.S. If the road to the M.D.S. is clear, the only work necessary is the re-application of loosened dressings, etc., and urgent first aid and "triage"; apart from this the A.D.S. is a relay post or car post, and nothing more.

If evacuation is held up behind the A.D.S. and numbers of wounded are accumulating, it is a different matter. It becomes no longer merely a relay post, but a place where the patient must be treated and cared for until he can be evacuated. Even then only the minimum amount of equipment should be unpacked.

As a general rule, it may be laid down that the A.D.S. should not be opened up completely until the influx of casualties greatly exceeds the efflux and stagnation on a large scale has set in. Technically, an A.D.S. is "opened" when the unit is established in a certain locality and ready to deal with casualties. An order to "open" an A.D.S. means this and nothing more.

If motor ambulances are used in front of the A.D.S., the question should be considered as to whether, when once loaded, they should not proceed direct to the M.D.S. It is unsound to load a motor ambulance up and unload it again about a mile further back.

In mobile warfare an A.D.S. is not the place for elaborate medical procedure. It is only a relay on the line of evacuation, and every effort should be made to get cases back quickly to the M.D.S., where they can be attended to more efficiently in comparative quiet and safety.

Another point not always realized is that much distance is not saved by siting A.D.S.'s close up. If there are three R.A.P.'s in a brigade they will often be one mile apart on the average, and distance from the flanking R.A.P.'s would therefore be at least a mile and the line of evacuation nearly parallel to the front, which is not desirable (see fig. 2). With large frontages the solution appears to be to put out two car posts for each brigade front, i.e., a car post for each one or for two R.A.P.'s.

It may sometimes happen that medical posts such as A.D.S.'s are approximately sited by the A.D.M.S. from the map, there not being time or opportunity to reconnoitre the ground. It must be recognized that this siting is only approximate, and if the senior medical officer on the spot

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finds the position unsuitable it is his duty to select a suitable place near at hand and report its position. He should, however, put a guide on the original point selected for him so that intercommunication is not interrupted pending the receipt of his report.

Siting of medical posts by a map, the scale of which may be one inch to the mile, or less, is a difficult matter. A glance at the one inch one mile ordnance map will show how difficult it is to follow contours and small details without constant practice.

In siting medical posts near the line, very obvious points on the map such as cross and main roads, or villages close to the line, should be avoided unless adequate protection is available. A couple of hundred yards away will make all the difference.

Sites on hills are conspicuous and liable to be shelled; deep depressions may become untenable from gas.

To facilitate liaison, A.D.S.'s should be sited as near as possible to Brigade Headquarters (2nd Echelon), report centre.

Provision to meet expansion must not be forgotten.

Walking Wounded Collecting Posts.

In the Great War these were organized in some central part of the restricted divisional area, within walking distance of the line or on a light railway. It is suggested that where the divisional front may be seven miles and the depth correspondingly great, they are not always necessary or feasible.

If, however, casualties are heavy, some arrangement must be made to relieve the A.D.S.'s and M.D.S.'s of the presence of large numbers of slightly wounded, but it is problematical whether a portion of a field ambulance could be spared to work a W.W.C.P. as a separate and isolated entity; the less medical units are split up the better, otherwise control is hampered and elasticity suffers.

It may therefore be stated that if a W.W.C.P. is considered necessary it should be close to an existing A.D.S.; probably more than one will be necessary. Arrangements for extra transport to evacuate the W.W.C.P. will usually be necessary. It is sometimes possible to utilize the returning supply lorries for this purpose. Such cases should be evacuated direct to the C.C.S. and not to an M.D.S., the necessary clerical work being carried out at the W.W.C.P.

Main Dressing Stations.

These are situated, as a rule, beyond "field gun" range[1] (i.e., 18-pounders

[1] The range of field guns has been increased nearly 50 per cent since the Great War, by increasing the possible elevation on the carriage or by improvements in fuses, etc.

Our 18-pounder has a maximum range with "H.E." of 9,000 yards, and the 4-5 field howitzer a range of 7,000 yards. The range of the corresponding gun in Continental armies is similar.

If it is desired to keep beyond range of medium guns, the M.D.S. should be six miles back at least.

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and light field howitzers), and should therefore be about four miles behind the A.D.S.'s.

They are, of course, more elaborate than A.D.S.'s, but mobility must not be forgotten. They cannot, however, be pushed about like pawns on a chess board. When moving they cannot work.

They must be in some place easily found and with plenty of room for expansion. A "place" of this description if too far forward receives unwelcome attention from the enemy.

The further back they are, within limits, the less likely are they to be moved, and the more work they can do; two or three extra miles in a motor ambulance make little difference to the rate of evacuation.

The minimum equipment necessary for the work in hand should be unpacked to commence with.

The M.D.S. is formed by the headquarters of one field ambulance, the headquarters of another being parked near by. As a rule only one M.D.S. is required for a division at the commencement of an action.

If, however, the roads from the six to seven mile divisional front do not tend to converge at one point, it may be necessary to have two M.D.S.'s.

A brigade acting semi-independently at some distance, say five to six miles away from the main force, might have a complete field ambulance attached, which in this case would form its own M.D.S., making two for the division. At least one headquarters must be ready to move immediately, i.e., that belonging to the Reserve Field Ambulance.

Extra Equipment.

The tables of equipment are necessarily designed to cover a number of different situations; in the late war field ambulances had no less than fourteen different rôles, ranging from their normal functions to that of semi-immobilized "hospitals."

Each C.O. has his own ideas on equipment, and when mobile action is contemplated a certain amount of equipment will have to be dumped in order to make room for other material considered necessary.

The following equipment extra to that shown on A.F. G.1098 and A.F. I.1248-4 is usually necessary for any action; the quantity necessary is the maximum that can be carried. It is surprising how much may be taken without overloading the transport, as field ambulance equipment is bulky rather than heavy. Raves can be fitted to the limbered wagons to increase their capacity, and six to twelve extra stretchers can be carried in the rear limbers if strapped over the existing equipment. Extra boxes of dressings and splints can be carried in motor ambulances and horsed ambulances.

Sandbags, Empty.—These are useful for carrying dressings and splints, etc., required by company stretcher-bearers, also for making cover when filled—a stretcher supported on eight filled bags makes an excellent "bed" and on twenty-four a good operating table.

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Stretchers.—The number shown on G. 1098, i.e., 48, is considered inadequate, at least twenty-five extra are required in each field ambulance. It should be noted that stretchers coming down under casualties must be replaced and sent up to the R.A.P.'s, etc. The same applies to certain other equipment.

Extra Blankets and Waterproof Sheets.—They are necessary for wrapping up "shocked" cases, for replacing "gassed" clothing, and for shelters.

Hospital Clothing and Pyjamas.—At least fifty extra suits are required for "gassed" and other similar cases.

Extra Dressings and Splints.—First field dressings, gauze, wool, bandages, Thomas's knee, thigh and arm splints.

It is a convenience if the extra dressings, etc., are put up in rough cases and of not more than twelve pounds weight, so that during an action the headquarters can keep field ambulance companies and the regimental establishments supplied with dressings, etc., to replace expenditure. The word "headquarters" is used above advisedly, as it is a mistake to make dumps of extra equipment far forward; it is liable to be lost during a mobile action, and this may result in a real shortage later on.

Extra directing flags and poles are necessary owing to the wide frontages.

Hot-water bottles are required in large numbers for the treatment of shock.

Extra Rations and Medical Comforts.—If possible sufficient to feed 500 men. In mobile warfare the lightly wounded are as much in need of food and hot drinks as they are of medical attention, often more so.

It must be borne in mind that, although a field ambulance is equipped for 150 patients, it may have to accommodate temporarily three to four times that number.

In the late war 1,250 cases came through one field ambulance in twenty-four hours! During mobile operations in Palestine one field ambulance carried six tons of extra equipment and stores. They were all expended in three weeks, as the advance had taken the unit out of reach of any source of medical or ordnance supply.

The Handling and Dispositions of Divisional Medical Units.

This may be considered under several phases:—

(1) Embarkation and entraining to the seat of war.
(2) In the concentration area.
(3) During the march into action.
(4) The battle, encounter, pursuit, defence, retreat.

Embarkation, etc.—This is carried out by the embarkation staff, and the arrangements are often out of the control of the A.D.M.S., but he should, whenever possible, make representations to ensure that a complete

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field ambulance accompanies each brigade, so that they will be on the spot when required. They will be rationed by the brigade, and the brigade staff will become accustomed to a new and often unfamiliar unit.

The state of affairs in August, 1914, may be remembered. During the Battle of Mons one division had no field ambulances, several had only one or two, none had their complete complement. They were miles behind and out of touch. The moral effect of this on troops, however gallant and well-trained, fighting their first battle in a campaign, may be considerable.

Field ambulances were detrained "in the blue" with inadequate orders or none at all, and making their way towards the sound of the firing did what they could, often finding themselves with a strange division; many, as noted above, did not arrive at all. This state of affairs was due to insufficient liaison between the staff and the medical services, and to not unnatural inexperience in handling large formations.

If possible, equipment and transport should accompany the field ambulance at all times. This is an integral part of the unit, without which it cannot function, a point often not realized.

Do not put men in one ship, equipment in a second, and animals in a third, if it can be avoided.

Equipment should be packed so that the most necessary things are loaded on last, they will then be the first to be disembarked.

The contents of the "bearers' carts" (No. 1 L.G.S. wagon) will be the first required, then the remainder of the company equipment. The heavy stores belonging to headquarters can come later.

As regards priority of embarkation of divisional medical units, if the division is to remain in a concentration area for some days, the Field Hygiene Section should be there early. This is the first mention of a unit which is occasionally forgotten in the rush of mobile warfare. Its expert personnel will be required to supervise sanitary work in the area.

In the Concentration Area.—In this each infantry brigade with its attached troops (artillery, signals, R.E., R.A.S.C. and R.A.M.C.) is billeted in a certain area or certain groups of villages. A field ambulance is usually situated in each brigade area, and acts as an A.D.S. The field ambulance in the rearmost area of all acts also as a M.D.S., and all sick of the division requiring evacuation are collected there pending evacuation by the M.A.C.

If however the division is in "close billets," as in a town, it may be convenient for one field ambulance to carry out the duties of A.D.S. and M.D.S. for the whole formation and thus avoid the necessity of opening the other two field ambulances at all.

Sick, other than "M. and D." cases, are collected by the motor ambulances of the field ambulance from the R.A.P.'s at fixed times once or twice a day, are re-examined and if considered suitable for evacuation are transferred to the M.D.S., where they are evacuated by cars of the M.A.C.

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to the C.C.S. according to a fixed time-table. The number of sick requiring evacuation from a division would be approximately 0·3 per cent of the strength; of these two-thirds would be "sitting" cases and the remainder "lying." Whether sick would be "detained" at the M.D.S. for a few days or not would depend on the probabilty of an early move.

The field ambulances in the forward areas must be prepared to move in a few hours and the rearmost unit at twelve hours' notice.

The Field Hygiene Section will be hard-worked. Although in the late war "Q" was responsible for bathing and disinfestation arrangements, there is no unit laid down in war establishments to do this work, so it will presumably have to be carried out by the Field Hygiene Section to commence with. Part of its personnel will also be required to supervise sanitary work in the brigade areas in conjunction with the R.M.O.'s.

The Field Hygiene Section would, therefore, be sited near the centre of the divisional area, and in some factory or institution capable of functioning as a bathing and disinfestation centre with a minimum of improvisation.

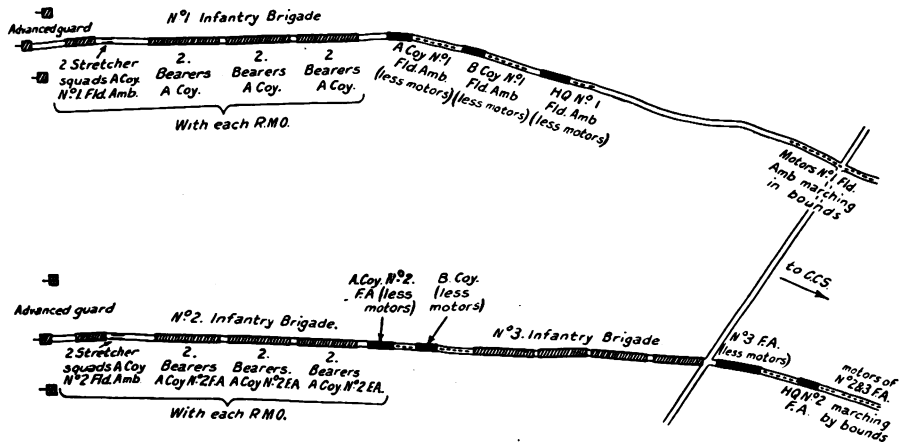


FIG. 1.—Showing typical arrangement of medical units with a division during an approach march on two parallel roads (units other than Infantry Battalions are omitted).

THE MARCH INTO ACTION (fig. 1).

(*a*) *Dispositions of Medical Units.*

It was sometimes the practice before the Great War to place all field ambulances together at the rear of the division. As a division occupies some fifteen miles of road (a day's march) the incorrectness of this is obvious.

Airplane and other casualties make it necessary for medical formations to be dispersed through the column.

Part of a field ambulance must march with each "infantry brigade and attached troops" so that it may be in close touch when the moment of encounter arrives.

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If a brigade is forming an advance guard or is marching on a parallel road over four miles away from the remainder of the division, or is for any reason out of immediate touch, a complete field ambulance should accompany it. The following may be taken as typical dispositions for medical units on the march when an action is imminent. The division is presumed to be marching on two parallel roads some distance apart with few or inconvenient connecting roads. In mobile warfare formations usually march on parallel roads in breadth whenever possible so as to facilitate deployment over the extensive frontages which now obtain.

Let it be supposed that No. 1 Brigade is marching westward on one road and Nos. 2 and 3 Brigades in that order on a parallel road to the south the two routes being over four miles apart.

(*a*) No. 1 Field Ambulance follows No. 1 Infantry Brigade, its motor transport moving in rear by "bounds."

Starting time and point will be arranged between O.C. No. 1 Field Ambulance and the Brigade Commander concerned under instructions issued by A.D.M.S. in his R.A.M.C. (in India "Medical") Operation Orders.

(*b*) No. 2 Brigade is immediately followed by one or two companies of No. 2 Field Ambulance with the horsed transport. Starting place and time arranged as in (*a*).

(*c*) No. 3 Brigade (which will go into reserve) is followed by No. 3 Field Ambulance complete (less motor transport). This field ambulance will be used as a reserve. Starting time and place will appear in Divisional March Table or A.D.M.S.'s Orders.

The companies attached to Nos. 1 and 2 Infantry Brigades will be in close touch with their Brigade Headquarters, and will be prepared to form collecting posts (car posts) and A.D.S.'s as and when required in consultation with their respective brigade staffs, reporting position of these to O.C. field ambulance and through him to A.D.M.S. The O.C.'s of field ambulances will usually march with their headquarters, but must keep in touch with their companies and with respective brigades (they are now provided with motor cars) and with A.D.M.S. by motor cyclists.

(*d*) Headquarters of No. 2 Field Ambulance marches in rear of No. 3 Field Ambulance, and will be prepared to form a M.D.S. under orders from A.D.M.S., and also to take in casualties occurring on the march, starting time and place as in (*c*). It is placed behind No. 3 Field Ambulance in this case, so that latter may be in close touch with the reserve brigade, also its position will leave it the correct approximate distance from the front when the division deploys.

(*e*) The Field Hygiene Section follows immediately behind Headquarters of No. 2 Field Ambulance, starting time as in (*c*). Its motor transport accompanies that of No. 2 Field Ambulance.

(*f*) Motor transport of Nos. 2 and 3 Field Ambulances follows by bounds in rear of the division, reporting position from time to time to A.D.M.S, and to their own field ambulance headquarters.

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Note.—(*g*) The number of field ambulance companies attached to brigades depends on circumstances. If a heavy action is expected, two should be attached—one company has only thirty-six stretcher-bearers, and as a brigade and attached troops takes up some five miles of road, the second company will be approximately two hours' march bebind if further to the rear.

(*b*) *Medical Arrangements on the March.*

Casualties occurring on the march would be notified by the R.M.O. to the field ambulance company marching with the brigade. The company would accommodate these in the most suitable manner, either carrying them along in their horsed ambulances, if slight, or putting them under cover and notifying Headquarters No. 1 or 2 Field Ambulances of their whereabouts by means of despatch riders. The field ambulances concerned would arrange to collect these casualties by means of motor ambulances when the troops have passed on and left the roads comparatively clear.

Arrangements would be made by the A.D.M.S. for the M.A.C. to keep in touch with the Headquarters of Nos. 1 and 2 Field Ambulances, the position of these at certain times or, if this is not possible, the exact route along which they are moving being notified to the M.A.C.

It will be noticed that No. 3 Field Ambulance does not enter into the medical arrangements.

The Encounter (fig. 2).

(*a*) *Arrangements in Forward Areas.*

(1) When contact is established with the enemy the O.C.'s field ambulances or companies affiliated to brigades will keep very close touch with their respective Brigade Headquarters, so that they may have early intimation of the situation in front and of the position of R.A.P's. This information must be passed back to their superiors.

(2) The O.C. field ambulance, or O.C. company, will fix sites for his A.D.S. and C.P. in consultation with brigade, assembling his wheeled ambulance transport and bearers at the latter place.[1] He will receive information from A.D.M.S. and brigade of the site of M.D.S.'s and W.W.C.P.'s (if formed). He will notify A.D.M.S. of his dispositions. Brigades will notify battalions of the sites of C.P.'s and A.D.S.'s. This information should also be sent direct by O.C. field ambulance, etc. to R.M.O.'s. The field ambulance stretcher-bearers already attached to the R.A.P.'s will bring back the first lying cases and then guide the other field ambulance bearers to the R.A.P.'s. The site of these is usually near

[1] Whether the O.C. company or O.C. field ambulance would site the C.P.'s and A.D.S.'s would depend on the time available. If time was short they would have to be sited by O.C. companies.

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Battalion Headquarters. Walking wounded will be directed to the A.D.S.'s or W.W.C.P.'s.

(3) As soon as the influx of wounded exceeds the number which can be speedily evacuated he will open out his A.D.S.'s gradually to meet the situation.

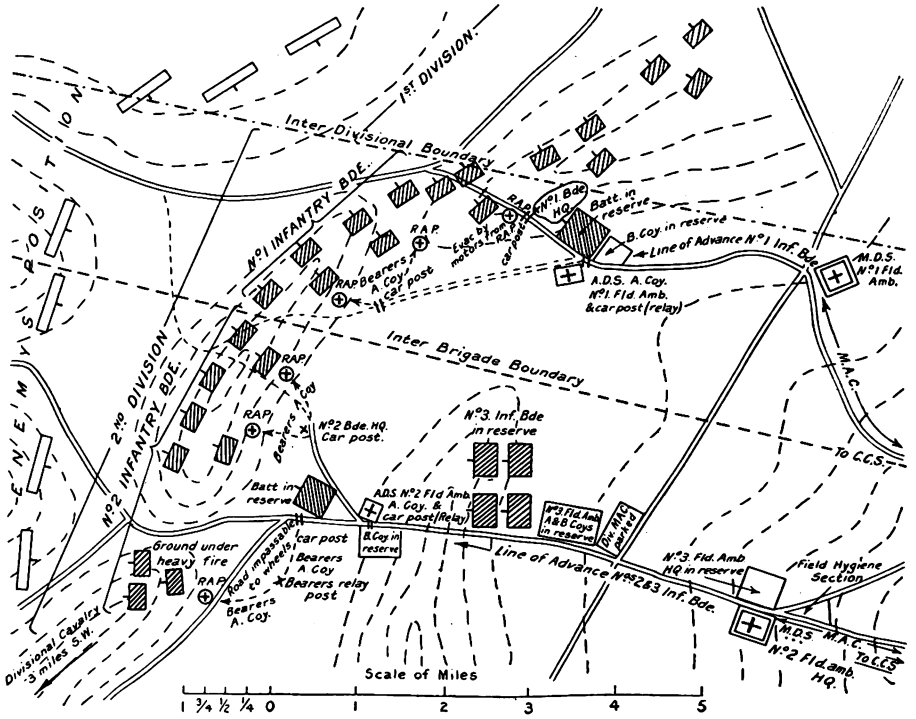


FIG. 2.—Rough scale diagram showing typical dispositions of troops and medical units at the commencement of an action.

It will be noticed in fig. 2, which shows the actual dispositions of troops in a certain tactical scheme, that the divisional front was seven miles. The R.A.P.'s were on the average over one mile apart. It was therefore necessary to establish two car posts for each brigade, the bearers working between these posts and the R.A.P.'s, except in one instance (right battalion of No. 1 Infantry Brigade), where cars could evacuate direct from the R.A.P.

The A.D.S.'s at the commencement of the action acted as relay car posts (i.e., two cars were kept there and replaced cars returning from C.P.'s) and also as W.W.C.P.'s.

It is thought that with these large frontages this arrangement would be the normal one.

The alternative of having two A.D.S.'s for each brigade would be incorrect, as no local reserve would be available.

Only three companies per battalion are shown in the sketch, as the M.G. Company would probably be divided up.

(4) The second company (B Co. in the fig.) will be kept in reserve under the orders of the O.C. field ambulance near the A.D.S. as long as possible. If heavy casualties occur in a certain sector, or if the advance

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continues out of "range" of the existing A.D.S.'s, they will be available to deal with the situation.

It must not be forgotten that the A.D.M.S. may wish to move a company in accordance with information not available to brigade.

(5) If a proportion of motor ambulances have been sent up to companies, single cars should be established at C.P.'s with a relay car post at the A.D.S.; as loaded cars approach A.D.S. an empty one is sent forward to take its place; convoys of motor ambulances should not as a rule be used in forward areas.

(6) Any move of the C.P.'s or A.D.S.'s should be notified to the next superior.

(7) It must be remembered that if the advance is rapid it may not have been possible for the regimental stretcher-bearers to get all lying cases back to the R.A.P.'s, so that groups of wounded will have to be searched for and collected in consultation with the R.M.O., help being obtained from brigade if necessary, as the number of stretcher-bearers in a field ambulance is usually not sufficient for this work.

The Reserve Field Ambulance bearers should not be used for this purpose except as a last resort, and under explicit orders from the G.O.C., as otherwise the A.D.M.S. has nothing left to meet a sudden change in the situation or to conform to the movements of the Reserve Brigade, and chaos is likely to occur later.

(8) *The Divisional Mounted Troops.*—A difficult problem is to evolve some method of getting in casualties from the divisional cavalry (one squadron), or from a detachment of "tanks."

As regards the former, it is not easy to help them, as they are widely scattered in small bodies over a 2 or 3 mile front "out in the blue," feeling their way forward, getting into touch with the enemy, sending back reports, and altogether having a very busy and mobile time. Their casualties, unless they run into a trap, are not as a rule heavy, but will be widely scattered. They are quite out of touch with the field ambulance; something must, however, be done for them, and it is suggested that one light motor ambulance with two stretcher-bearers should be attached to their A echelon transport, and used to convey casualties from notified spots to some place on the road whence they may be collected by cars sent out from the nearest field ambulance, somewhat on the lines laid down in "R.A.M.C. Training" for Cavalry Field Ambulances.

As regards detachments of "tanks," similar arrangements would be made; each tank has a first-aid box, and casual wounded would have to remain in the tank until it returned to its "base," as a tank will not stop when in action, being then more likely to be hit.

If a tank is hit directly by a shell its crew will be beyond the reach of first aid. Tanks must replenish with petrol and ammunition, which will be brought to some "base" in "tank" vehicles, and there a light motor ambulance and some personnel, etc., should be in readiness to remove casualties.

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(9) The artillery must not be forgotten; some batteries may be a considerable distance from the R.A.P. of the single M.O. in charge of the Field Artillery Brigade, and they may also be some distance from other medical posts. Under these circumstances their wounded must be evacuated by motor ambulances from time to time.

Administrative instructions should direct them to apply to the nearest medical post.

(*b*) *Arrangements in Rear.*

(1) *The M.D.S.* will usually be formed by the headquarters of one of the field ambulances, whose companies are responsible for clearing its front. One or two M.D.S.'s may be formed according to circumstances (see before).

(2) *Disposal of Motor Ambulances.*—The A.D.M.S. will direct a proportion of the motor ambulances to rejoin the headquarters of their respective field ambulances, retaining under his own control if necessary a number of cars to work as a divisional motor ambulance convoy in order that he may be able to aid in evacuation if heavy casualties occur in a certain sector of the line. He will also arrange with "Q" for the evacuation of the lightly wounded by means of returning supply vehicles or specially ear-marked lorries. These would usually be evacuated direct from A.D.S.'s or W.W.C.P.'s to the C.C.S.

(3) *The Reserve Field Ambulance* should be kept intact as long as the Reserve Infantry Brigade is not deployed, and if possible until the enemy's counter-attack has been dealt with. It should, however, be in touch with the principal M.D.S., where its personnel can help in "shifts."

As regards the Reserve Brigade, if this eventually advances through another brigade it might be feasible to use existing A.D.S.'s, C.P.'s, etc., and reinforce the bearers working in the area from the Reserve Field Ambulance. If the advance is over two miles, new A.D.S.'s will have to be formed further forward, allowing the original ones to close and leap-frog in their turn.

If the Reserve Brigade operated to a flank, however, a new series of A.D.S.'s, and even M.D.S.'s may be required. *Early* information on this and other points should be given to the A.D.M.S. by "G."

The general principle of not splitting up a field ambulance more than is necessary, and not removing it from the control of its own C.O., must not be forgotten, especially in mobile warfare over wide frontages.

Although the dispositions shown in fig. 2 may be taken as typical it may be that in a rapid advance without heavy opposition three brigades would be in line over an eight to nine-mile front, with perhaps six A.D.S.'s and three M.D.S.'s functioning either side by side or more likely in echelon. On the other hand, a division forming part of a larger force meeting with heavy opposition might act on a one-brigade front with only

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one A.D.S. and one M.D.S. This latter formation is, however, unlikely in mobile warfare.

(4) The Field Hygiene Section should be sited near the M.D.S., so that its personnel can assist there if required.

The Defence.

The disposition of medical units would be generally as in the encounter, but more careful and detailed organization can be carried out, and the A.D.M.S. would personally site the A.D.S.'s and W.W.C.P.'s and M.D.S.'s. A.D.S's would be dug in and protected, and as a rule not so far forward as in an encounter or attack.

Probably the defence would be on a smaller frontage, and conditions would approximate to those obtaining in "trench warfare," for which see "R.A.M.C. Training."

Alternative positions for medical posts well to the rear would be chosen by the A.D.M.S. in consultation with the divisional staff.

The Pursuit.

General arrangements would be as in the encounter, but it would probably be necessary to use all three field ambulances, advancing them by leap-frogging, M.D.S.'s taking over sites of A.D.S.'s, A.D.S.'s of R.A.P.'s, and so on. Organized R.A.P.'s might not be established and dumps of wounded left under cover by the R.S.B.'s would have to be located and cleared.

Two of the weak links in the medical chain would make their presence felt, i.e., the paucity of stretcher-bearers and the "stretching" which is likely to take place between a mobile M.D.S. and a practically immobile C.C.S.

Help from the combatant troops would be required, and also extra transport to deal with walking wounded and to move up the "light" section of the C.C.S. Whether either would be forthcoming under such conditions is a debatable matter, as the combatant services would have their hands full in turning the enemy's retreat into a rout.

In the event of the "stretch" resulting in a "fracture," it might be necessary to withdraw a field ambulance and make it function as a C.C.S. as a temporary measure.

The Retreat.

Dealing with casualties in a retreat is a difficult matter and much depends on individual initiative, but, as far as possible, sites for medical posts in rear should have been reconnoitred previously. All heavy medical equipment and all transport except the minimum must be sent back out of reach of the enemy to a point behind the proposed limit of the withdrawal, where the headquarters will open a M.D.S. The stretcher-bearers

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and motor ambulances alone are of any use and equipment should be limited to that carried in, say, one limber per company and in the improvised dressing boxes of the motor ambulances.

The stretcher-bearers would work among the troops just covered by the rear guard.

If wounded had to be abandoned, permission must be asked before leaving a minimum of personnel with them. Those abandoned should be the more serious cases, the lightly wounded who will fight another day must be got away. Sacrifice of medical personnel should be avoided as far as possible, they will be badly needed later. "It is not magnificent but it is war," and the above principles, which are generally held, will go against the grain.

What usually happens is this: The Reserve Brigade organizes a line of defence some four to five miles back and holds this to cover the retreat of the remainder of the force. The Reserve Field Ambulance with this brigade will form A.D.S.'s and M.D.S. The original M.D.S.'s will of course be too far forward and will close at once and withdraw behind the limit of the retreat, the casualties being evacuated by the M.A.C., and fresh casualties switched over to the Reserve Brigade M.D.S.

The companies will work as suggested above, evacuating casualties to the "Reserve" Field Ambulance A.D.S.; as soon as possible casualties should be switched to the new M.D.S.'s formed behind the limit of retreat. The medical posts of the covering brigade must be kept as clear as possible as they may have to get out in a hurry. As the headquarters of a field ambulance is mechanized, the M.D.S.'s behind the limit of retreat should be able to open fairly quickly and will be used as soon as possible. The M.D.S. and surplus medical equipment and transport of Reserve Brigade will then retire, and the retreat of the brigade will be managed in a manner similar to that suggested before, casualties being evacuated direct to the new M.D.S.'s. It is quite possible that at the same time the C.C.S. will be engaged in packing up and getting rid of its casualties to railhead, and the strain thrown on the M.A.C.'s will be enormous.

Every means of transport will have to be used to get back the wounded, including supply lorries, if obtainable, transport vehicles, etc.

Equipment.

The horsed ambulances, with four horses each, are useful for work where motors cannot go. When a motor ambulance really capable of going across country has been invented, the horsed ambulance will disappear, at any rate in Western European warfare. They are very conspicuous and early steps should be taken to make them less so, by painting in a similar manner to motor ambulances. If for any reason they are required to be conspicuous, as when collecting wounded between the lines during an "armistice," a "Red Cross" flag could be flown from them.

Medical and other equipment is suitable for the conditions visualized,

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but if a change to pack transport has to be made at short notice, as often happens in Eastern warfare, its carriage presents many difficulties, as the panniers are not of uniform weight. It is interesting to note in this connection that the R.A.S.C. have worked out an alternative "pack" scheme for Divisional Supply and Transport.

A Weak Link in the Chain of Medical Aid.

As mentioned before, there is a weak link in the chain of medical aid where the conditions of mobile warfare have to be met, and that is the comparative shortage of stretcher-bearers taking into consideration the much larger area of ground which will have to be covered.

(1) *Regimental stretcher-bearers.*—The regulation number is 16 per battalion, organized into eight squads of 2 men each or four squads of 4 men each.

These bearers may have to collect lying cases over an area about one mile broad and about 1,000 yards deep. If ten per cent casualties occur, approximately twenty lying cases would have to be carried back to the R.A.P., each squad (if organized into four squads) would therefore have to carry five cases 1,000 yards and return = six miles, three miles of which would be carrying a man and his kit, and this might have to be done after a long march.

It may be argued that wheeled transport would eventually be brought up closer, but, on the other hand, the fact that the battalion might be moving forward should be taken into consideration, also the effects of enemy interference. It will, I think, be obvious that their numbers are not sufficient and should be at least doubled.

(2) *The field ambulance bearers* are also, I suggest, insufficient; even if the eighteen squads of the two companies are working the proportion is about the same "per battalion" as that of the regimental stretcher-bearers, and as the average hand carry to a collecting post would be about 1,000 yards their work would be equally arduous (see fig. 2).

The numbers of bearers in a field ambulance was reduced by one-third as the result of a reorganization based on an abnormal type of warfare.

The "lost subdivision" will be badly needed in mobile warfare, unless its place is taken by a larger number of armoured cross-country motor ambulances.

The reply that "help must be obtained from infantry formations when casualties are heavy" is not quite sound, as with the more dispersed formations now in force such help will not be forthcoming readily. The element of surprise is so much in evidence that a commander will be very reluctant to use reserve formations for this purpose.

Training of Personnel.

Of all our field medical units the work of a field ambulance diverges most from the normal peace-time work of the Corps.

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A field ambulance is the most "military" unit in the Medical Service, and although only coming into existence on mobilization, has to take its place in the division among highly trained troops. Its personnel in peace time has been employed on technical duties in hospitals and, owing to financial exigencies, with a minimum of military training. The reservists and specially enlisted men come as a rule from sedentary employment and have had no training whatever for a considerable time.

(*a*) The first thing necessary is to train all ranks as "soldiers" with the exception of the actual use of weapons, in other words, accurate and rigid drill and strict march discipline to inculcate steadiness and alertness and to shorten the "latent period" are necessary.

(*b*) Each man must then be trained in his own special work and practised in it until he can function almost automatically under conditions of stress. Every detail must be gone over repeatedly, from loading medical equipment into a wagon upwards.

(*c*) The technical personnel in headquarters and in the "A.D.S. party" of the companies have had experience in their work, as it approximates to what they have done in peace time, but quickness and method must be practised. *A field ambulance, when functioning, is always working against time.*

(*d*) *Stretcher-bearers.*—These require very special training and should be practised in stretcher drill, visual training, marching on bearings, deploying in extended formations, control by signal and in the use of ground and cover. (This matter has been described at length elsewhere, see "Random Notes on Training"), and in really *practical* first aid.

In training these men in first aid, it is not sufficient to recite pages of "R.A.M.C. Training" to them. The instruction should be by "demonstration." It is easier to learn by the eye than the ear. The practical methods, based on what they will be called on to do later, should be well rubbed in: the carriage of the wounded with reference to their injuries, the controlling of hæmorrhage, splinting of fractures, treatment of shock, etc.

(*e*) *Transport Animals.*—The R.A.S.C. N.C.O.'s are experienced men, but like all lovers of horses they sometimes like to see their animals fat and sleek, and the question of "training" is forgotten. It is as well to have an officer placed in charge of the transport who is keen on the job and has had previous experience. The animals should be got into hard training gradually, and if the field ambulance is not moving they should be exercised to the extent of 10 miles per day, including journeys to and from water.

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NOTES ON SCHISTOSOMIASIS IN THE SUDAN.[1]

By Major T. PARR,
Royal Army Medical Corps.

I.

The complete medical survey of the Sudan is a matter of peculiar difficulty on account of the vast size and the wild nature of the country. Other factors which impede investigation are the lack of water, of good roads and the variable climatic conditions. The whole area is sparsely populated and the tribes are mostly savage, ignorant and primitive in their characteristics. Much excellent work has been done in the short period of the British occupation, but the shortage of medical personnel and funds has greatly hindered the progress of medical work.

The exact geographical distribution of schistosomiasis in the Sudan is, therefore, not yet definitely known, but as will be seen later the areas of potential spread are very large.

Writing in 1904, Balfour said that endemic hæmaturia (bilharziasis) was of frequent occurrence in the Egyptian soldiery and was not supposed to exist in the Sudan save in such cases as had acquired infection in Egypt or elsewhere. Three Khartoum schoolboys (two of them brothers), however, had been sent to the laboratories and all three of them had shown blood and characteristic ova in the urine. They had all three drunk water from a school well, and all three had drunk from, and bathed in, the Blue Nile. All the schoolboys were examined (seventy-three in number) and seventeen per cent were found to be infected.

In the same year cases of schistosomiasis among Arabs who had not been to Egypt were reported from Kassala Province. "They may have visited Abyssinia."

Again, writing in 1908, he said, "At present it is not much in evidence, save amongst those who have lived in Egypt."

In 1909 the disease was found to be very prevalent in West Sennar (the present Blue Nile and Fung Provinces). Although suspected to be present before 1921, at that date its endemicity in Dongola Province was proved.

Since the war, which naturally prevented much actual research work, the Medical Directorate have adopted a general progressive policy in regard to the detection, prophylaxis and treatment of schistosomiasis. So much so, in fact, that it has been detected and dealt with in various places in the provinces of Kordofan, Darfur, Nuba Mountains and the White Nile

[1] Being extracts from a thesis presented for the M.D. degree and published by permission of the Dean of the Faculty of Medicine, Edinburgh University.

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Province. Cases have been reported as far south as Mongalla. There are no records of its having been found to any extent in the Bahr el Ghazal Province.

II.

Potential Endemic Areas.

It is of course understood that the question of endemicity and spread of the disease always postulates the presence of two factors, namely the infected individual, and of the intermediate hosts.

What has been said in regard to the actual distribution of the disease is equally true of the distribution of the intermediary hosts. Their exact range of distribution is not yet definitely known.

Leiper said, in reference to *P. boissyi*, that it had an extremely limited range in Egypt but a wide range in the Sudan, and that it had been recorded on several points of the White Nile from Abba Island to the Bahr el Zaraf. This was in 1916.

Archibald reported, in 1923, *Isodora* (*Bullinus*) *innesi*, the carrier for *S. hæmatobium*, as being present in quantity in Dongola Province.

The distribution as known at present would seem to be as follows:—

Province or District	Endemic carrier
Blue Nile Province (including Gezira Irrigation and the Fung Province)	*B. contortus*, *B. forskali*, *P. pfeifferi* and *P. alexandrinus*.
Nuba Mountains Province	*B. contortus*, *B. forskali*.
Kordofan	*B. contortus*, *B. dybowski*.
White Nile Province	*P. boissyi*.
Mongalla Province (Yei River)	*Physopsis africana*.
Dongola Province	*B. innesi*.
Upper Nile Province	*P. boissyi*.

When it is recalled that the freshwater, sinistral and spiralled snails of the genus Bullinus are the intermediary hosts of *S. hæmatobium*, and that for *S. mansoni* the small flat freshwater molluscs of the genus Planorbis act in the same capacity, it will be noted that in districts not included in the Nile Valley in the Sudan, the common type of schistosomiasis one expects to find is due to *S. hæmatobium* infection. This is borne out in actual practice.

Physopsis africana, which is the immediate host present in Mongalla Province, has been incriminated by Dr. Anne Porter as being a mollusc which harbours both *S. hæmatobium* and *S. mansoni*.

III.

The Economic Importance of Schistosomiasis.

The economic importance of schistosomiasis in a developing country like the Sudan, depending as it does on agriculture, cannot be overestimated.

In such a large country where the population is only about 6,000,000 it must be realized that the great obstacle to development is lack of labour.

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This is especially seen in the difficulty which the Sudan Plantations Syndicate have in gathering sufficient labour in the Blue Nile Province to do the necessary work of cotton growing. They employ large numbers of Falatah, a travelling fanatical Mohammedan people from the west coast.

Further the development of agriculture in the Sudan depends on adequate and, if possible, increasing supplies of water; this again is dependent on the opening up and developing of an increasing number of irrigation canals. These will of necessity radiate from the main water supply, which is the Nile and its tributaries, and, as there is an inexhaustible supply of potential hosts in the Nile, spread of infection to the irrigation canals will certainly follow.

The prophylaxis and eradication of the disease, therefore, present a very big problem for solution.

In Egypt, a country which is also largely dependent on agriculture and with similar difficulties in regard to water supply, Ferguson stated that in 1910 more than 1,000 post-mortem examinations made by him at the Kasr el Aini Hospital in Cairo revealed the presence of the disease in 40 per cent of Egyptian males between 5 and 60 years of age.

Leiper found, at a village called Marg, that forty-nine out of fifty-four school children were affected. It has already been noted that Balfour found seventeen per cent of school children infected in the Sudan in Khartoum in 1904. In Dongola Province 5,000 people (thirty per cent of the population) were examined in 1927 and 9·7 per cent were found to have schistosomiasis.

The incidence of the disease would seem to be considerably less in the Sudan than in Egypt, but the figures are hardly comparable as there is such a difference in the populations.

IV.

General Prophylaxis.

The Sudan provides an interesting illustration of the different methods which may be employed against schistosomiasis both in irrigated and in non-irrigated areas.

In a country such as this the nature of the terrain, the habits, religion and the customs of the people vary so greatly, that the problem is one which has to be solved separately for any given area.

The Gezira, in the Blue Nile Province, is an artificially irrigated area, where irrigation is under control, and where from the commencement of the scheme for cotton growing, scientific methods of approach to bilharzia treatment and prophylaxis have been put into effect with considerable success.

Dongola Province is an example of both an irrigated and a non-irrigated area, where for various reasons irrigation cannot be strictly controlled. It is a district with a comparatively small population which is an important source of intelligent labour. The inhabitants are moreover of the fanatical Mohammedan type. In this area we have, therefore, religious

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prejudices, deeply-rooted insanitary practices, and old-standing agricultural customs, complicating the prophylactic picture. Prophylaxis is, therefore, neither so thorough nor so successful as it is in the Gezira.

In both of these areas, where the water supplies are from the Blue and the White Niles respectively, prophylactic measures such as rotation of crops, Government control of water, efficient sanitation, examination and treatment of infected persons, clearing of vegetation and other measures of snail destruction and prophylaxis are all practised.

In this paper there is not the space to recapitulate, or discuss, these different methods. It is, therefore, proposed to deal with the third type of area found in the Sudan, which is the purely non-irrigated one.

V.

Schistosomiasis in a Non-irrigated Area.

In 1925-26 the writer was in medical charge of the Nuba Mountains Province and had the opportunity, in the ordinary course of duty, of noting the incidence of schistosomiasis among the peoples of that province.

The province has a population of about 478,200 people and an approximate area of 31,300 square miles. Artificial boundaries separate it on the north and west from Kordofan province, and on the east from the White Nile Province. In the south the Bahr el Ghazal, a tributary of the Nile, separates it from the Bahr el Ghazal Province. It consists largely of mountainous country and most of its eastern territory is unexplored and unmapped. The nearest point at which its territories approach to the Nile is at Kaka, and it has no real or permanent offshoots of the Nile running through it.

The greater part of the water supply is therefore adventitious in character and the inhabitants, owing to natural limitations, are concentrated in areas to the north, west, and south.

As part of a general scheme the Sudan Government are developing the growing of "rain cotton" in the province very successfully. Large areas are consequently under cultivation, and a large amount of labour is employed. In addition labour has to be obtained for the necessary work of repairing and developing roads, transporting merchandise, building, and other Government work. The people have at the same time to grow their own foodstuffs, otherwise they cannot live.

The presence and increasing incidence of a debilitating disease such as schistosomiasis with its potential powers of spread, makes it necessary that, if progress is to be maintained, its eradication should be attempted.

At Talodi, the chief town, there were two schools for boys, one maintained by the central Government and one by the local authority. The interesting point to note is that the larger school drew its scholars from the whole of the surrounding district, and the other, the school maintained by the local authority, from Talodi itself.

Except for a few children of either pure or mixed Arab descent they

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were all of Nubawi origin, and therefore shy, of comparatively low intelligence, and permeated with all the ignorance, apathy, and superstition common to their kind.

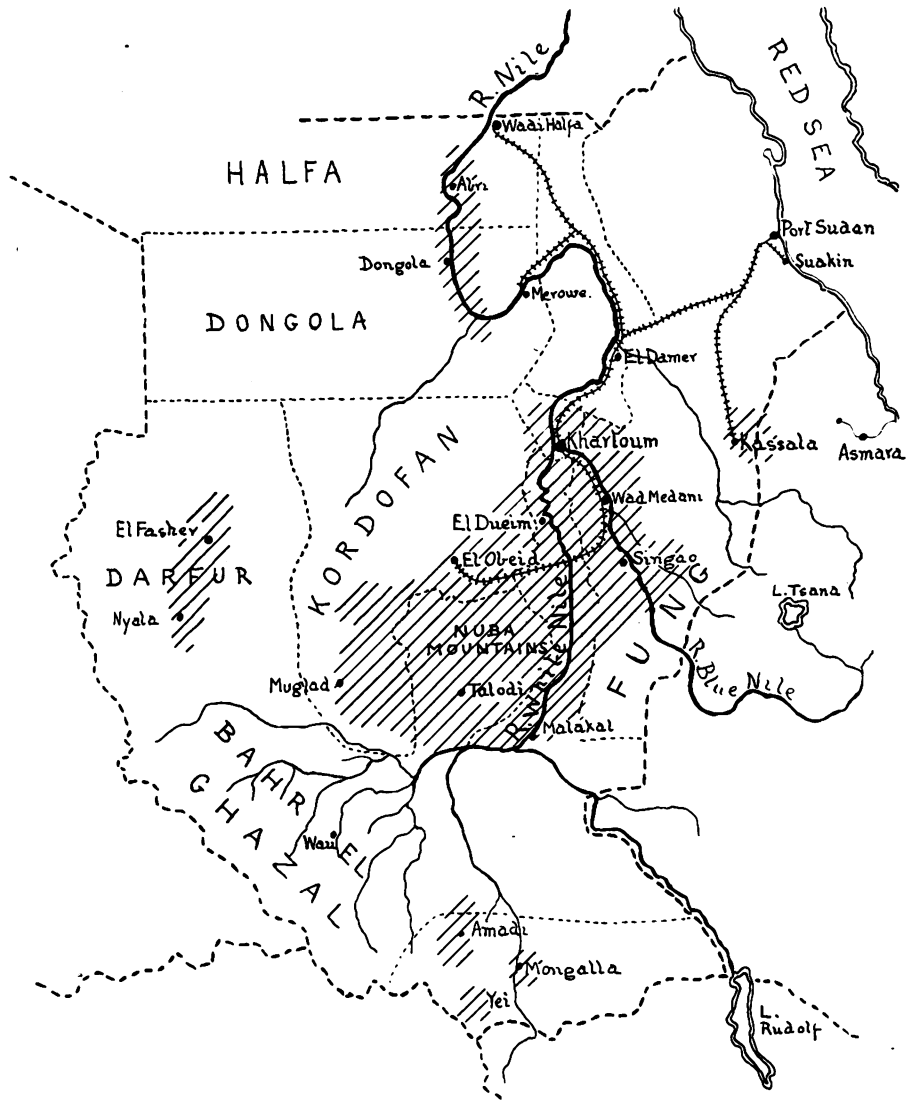


FIG. 1.—The shaded portions show approximately the distribution of bilharzia disease in the Sudan.

VI.

OBSERVATIONS AMONG SCHOOL CHILDREN AT TALODI.

These children at Talodi have been selected as a convenient example to illustrate the type of schistosomiasis met with in a non-irrigated area of the Sudan, and also to illustrate the wide distribution of endemic foci in

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a province which relies on adventitious and unconnected water supplies, and which, apparently, has no permanent watercourses draining into the Nile. A province which is, moreover, dependent to a large extent on the annual rainfall for the replenishment of these water supplies.

The incidence of the disease among these children should not be taken as typical of the incidence of the disease among the peoples of this particular province, as comparatively large numbers of cases were actually seen and treated during various tours made round the districts.

It is worthy of note that all, or nearly all, of the cases met with in this province were found to be suffering from the same species of schistosoma as that which prevailed among the school children, namely, *S. hæmatobium*. A study of the distribution of the intermediate hosts would lead one to expect this. In the two schools mentioned, the average number of scholars attending during the period of observation was ninety at the larger or Government school, and thirty-five at the smaller or locally controlled school.

The ages of the scholars attending the central Government school ranged from 7 to 8 years, to as high as 16 or 17 years. The local school consisted of small children whose ages varied from 4 years to 7 years.

During the period of nine months in which these school children were under observation seventeen cases of bilharzia were discovered. Sixteen of these were pure *S. hæmatobium* infections, and one only was found to be a case of *S. mansoni* infection. This case occurred in the local school among the younger children and, at the time of its occurrence, there was some speculation as to how infection had been incurred, as before this case, and subsequently to it, all cases of schistosomiasis found in the Talodi district were due to *S. hæmatobium*.

It was discovered subsequently that the child had been to Ed Dueim in the White Nile Province some nine or ten months previously with his father, and it was presumed that the infection was acquired there.

In only one case of the *S. hæmatobium* infections were rectal symptoms present and terminal-spined ova found in the fæces. Repeated examinations failed to reveal the presence of lateral-spined ova in this case.

The first and third stages of the disease as described in textbooks were not seen in these children. It may be taken as almost certain that the first stage of the disease is hardly ever seen amongst natives.

With a view to discovering possible endemic foci in the district, whenever a case was found the names of the patient and that of his father were taken. In every case the children infected were found to have been inhabitants of villages where bilharzia was known to be prevalent, or in which the disease was afterwards discovered. In none of the cases was infection found to have been derived from the Talodi Gebels (mountains) themselves.

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Statistics regarding the age of onset of the disease, or its monthly incidence, were unreliable for various reasons and have therefore not been quoted. Some children would only attend the schools for a month or two, and would then go back to their villages. They might then return to the schools for another short period. Others would commence attendance, perhaps, at the age of 16, and others again at the age of 4 or 5 years.

They were, on the whole, healthy and well-grown for their ages. The prevailing diseases amongst them were chronic malaria and dysenteric diarrhœa. This dysentery was due to various causes, but more often than not was amœbic in origin. As a result of the malaria enlarged spleens were by no means uncommon, occurring approximately in about twenty per cent of the total number of children.

VII.

Vesical Schistosomiasis (*S. hæmatobium*).

The symptoms of this form of the disease are well known and have been well described in various treatises and textbooks. No attempt, therefore, will be made to give a complete description of the disease. Only certain symptoms which occurred among the sixteen cases of pure *S. hæmatobium* infection found among the Talodi school children during the period under review, will be described and discussed.

The symptoms varied within wide limits. As would be expected, the most characteristic sign of the presence of the parasite in the wall of the bladder was the passage of blood at the end of the act of micturition. This terminal hæmaturia was sometimes accompanied by a sense of urinary irritation, but frequently no such irritation was experienced at all. Blood was contained solely in the last few drops of urine as a rule, but occasionally the whole of the urine passed was blood-tinged and periodically clots were noticed.

It should be especially noted that pain was not an essential or necessarily a prominent feature of the disease. Ova and blood were often passed in the urine without the patient experiencing any trouble. This was especially noted in four of the cases observed.

The cardinal symptom in eleven of the cases was a burning or scalding urethral pain (hence the native name of the disease "boule har" meaning hot urine). This happened during the passage of urine, but it was described occasionally as a deep-seated pain, perineal, or referred to the penis. Following this symptom came a terminal hæmaturia which was sometimes a constant feature, and at other times most irregular in its occurrence.

The pain when it occurred was not always referred to one area. It was many times complained of as occurring in the perineum, the urethra,

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the suprapubic region, or in the loins, and occasionally even in the small of the back.

As already noted in one case rectal symptoms were present with the passage of blood and mucus in the stools. Actually in this case the symptoms, with marked tenesmus, were so acute as to amount almost to a dysenteric attack. The patient's stool was actually being examined with a view to discovering the presence of amœbæ when the terminal-spined ova were discovered. This patient was found later to be passing terminal-spined ova in the urine also.

In his experience obtained with the Expeditionary Force of the Sinai Peninsula, O'Connor observed that clinically the most severe dysenteric cases due to schistosoma were associated with the species *S. hæmatobium.*

The blood-picture presented certain constant changes. In ten cases the average count was 9,045, thus revealing a moderate leucocytosis. There was a relative decrease of the polymorphs, and an average eosinophilia of 9·5 per cent was found on making differential counts.

No abnormality was noted in the red cells or hæmoglobin, except that usually a slight secondary anæmia was present.

VIII.

Intestinal Schistosomiasis (*S. mansoni*).

Only one of the series of cases was due to infection by *S. mansoni.*

The outstanding symptom in this case was marked emaciation. There was some pain found on palpation of the liver and spleen, which were somewhat enlarged. Inquiry elicited the fact that the patient had suffered from intercurrent attacks of diarrhœa and occasionally from fever. Pruritus was present round the anus. While under observation the intestinal symptoms were fairly slight and consisted mainly of a sense of rectal uneasiness, and occasional attacks of dysenteric diarrhœa, with the passage of blood and mucus in the stools. Tenesmus was sometimes complained of, and sometimes intestinal colic was present. The duration of the individual attacks of diarrhœa was not constant but varied from two to five days. Between the attacks the stools were solid and showed abundant yellow mucus.

Microscopical examination of the stools showed the presence of lateral-spined ova in the mucus. No ova were found in the urine.

Occasionally the stools were streaked with blood, but real clots were not observed macroscopically.

The blood on examination showed marked eosinophilia (12 per cent) and a moderate leucocytosis. The red cells had markedly pale centres and the polymorphs were decreased in number.

Pulmonary symptoms were absent except for the morning cough which these natives usually have.

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IX.

Treatment Adopted.

The infected children were treated by a short course of intravenous tartar emetic injections up to a total dosage of fifteen grains. The injections were given thrice weekly, the initial dose being half a grain in one cubic centimetre, the second one grain, and thereafter doses of one and a half grains were administered until the total amount had been given. This course was quite successful in all except five of the cases. The symptoms, that is to say the presence of ova, the hæmaturia, and the pain on micturition, disappeared, on an average, after the administration of ten grains of tartar emetic.

In five of the patients the hæmaturia, and the passing of ova returned when a week or two had elapsed after the completion of the course, the urine in the interval having been negative on examination. These five were then given a course of emetine by intramuscular injection, in exactly the same dosage and over the same period as for the tartar emetic injections.

This was quite successful in all the cases and at the end of the period under review the cure still seemed to be complete and there had been no recurrence of the disease in any one of the boys.

No untoward symptoms were noted except that in two of them abscesses formed round the site of intravenous injection. This happened probably because owing to the smallness of the veins (one patient was 5, the other 7 years of age), a small amount of the antimony solution had escaped into the tissues.

Usually a slight cough occurred after the tartar emetic injections, but to this no importance was attached. The same phenomenon has been noted to occur almost invariably after the intravenous injection of quinine given in the treatment of malaria.

The first injection was diluted with five cubic centimetres of sterile saline, and thereafter the saline was gradually increased to a total of ten cubic centimetres.

The emetine was diluted with an equal portion of distilled water for the intramuscular injections.

It should be noted that among these children a very careful watch was kept for signs of cardiac depression while the course of emetine was being given.

The results of the treatment were controlled by observations made upon the ova in the dejecta of the patients. Thirty to sixty cubic centimetres of warm water were added daily to the freshly passed urinary deposits. If ova are left too long in alkaline urine they fail to hatch, care was therefore taken that the deposits examined were always freshly passed. The diluted solution having been made in a glass vessel the hatching of the ova was watched.

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It was found that as the treatment progressed the ova took longer and longer to hatch, and finally they were no longer passed. Any that were passed in the later stages of treatment were dark and shrivelled.

Usually after about ten grains of antimony had been injected, ova failed to pass and the hæmaturia cleared up.

In the case of the *S. mansoni* infection direct observations were made upon the stools passed.

X.

The Therapeutic Attack.

The great advantage of the therapeutic attack is that the relief of symptoms is so obvious that the native's innate suspicions are removed, and his co-operation ensured without effort. It will be readily understood that without this co-operation successful prophylaxis is impossible of attainment.

The effect of successful treatment with antimony tartrate in countries like Egypt and the Sudan is that, as a rule, the natives are only too willing to give the method a trial and to be injected and cured. There is no interference with religious prejudices, long standing private habits, or economic practices.

They are getting, in any case, something for nothing, and provided the Government of the country concerned is an enlightened one and will provide the necessary facilities, the results are bound to be successful and gratifying.

By using therapeutic treatment close contact is secured with the native, and many opportunities are obtained for propagating simple sanitary truths to the people directly concerned.

This result we owe to Christopherson's discovery of the valuable effects of tartar emetic in schistosomiasis, which he made in Khartoum in 1918-19.

XI.

Prophylaxis in a Non-irrigated Area.

The Nuba Mountains Province is, as has been stated, dependent largely on adventitious water supplies. The natives differ markedly from the rest of the Sudanese in their racial characteristics, although they themselves vary in districts. Generally speaking, however, they are a tall well-developed race who are very attached to their native "gebels" or mountains. They are typical of the inhabitants of bilharzia-stricken countries in their ignorance and primitiveness. Implicit faith is displayed by them in their native "fikkis" (magicians or medicine men), and they are prone to view the white man and his works with suspicion.

For these reasons, together with their fatalistic apathy in regard to their own personal welfare, sick people are rarely seen in the early stages of an illness. They are much more commonly seen when nearly "in extremis."

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Education tends to break down this diffidence and lack of confidence, but, even so, only two out of the total number of cases of schistosomiasis in the school children actually reported sick of their own accord.

The people are accustomed to urinate and defæcate promiscuously all over the countryside, but not necessarily near water.

The Mohammedan population is small, and in this they differ markedly

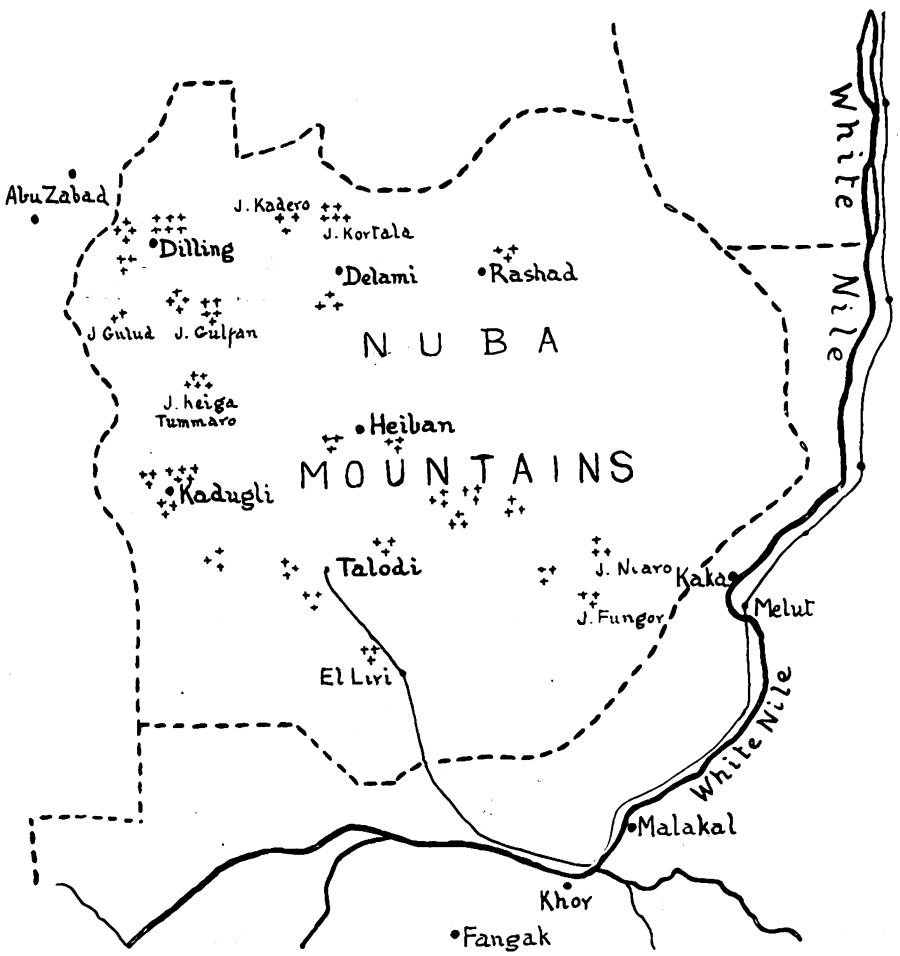


FIG. 2.—Approximate distribution of bilharzia disease in Nuba Mountains Province, Sudan.

from the natives of Dongola province (*vide supra*) who are mainly fanatical Mohammedans.

All the factors favourable for endemicity and spread of the disease are present in the Nuba Mountains Province. These are a warm climate, heavy but not continuous rains, abundant and wild vegetation, bad conservancy methods (in the native villages) and the fact that the natives wade through and drink any available water in an indiscriminate manner.

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The water supplies, which are abundant during the rainy season, gradually dry up in the dry season, and consists then mainly of "foulahs," "birkets" or "khors." That is to say, the water supply is mainly obtained from surface water contained in ponds, ditches, and shallow wells. On these both man and animals depend.

The snail propagating its species in the summer season is spread over the country by the heavy rains and naturally accumulates in these scattered watering places in the dry season; the infective native is present and so the vicious circle is carried on.

The scattered nature of the infection in the province is well shown by the map on p. 271.

There are monkeys and baboons in the province also, and it may be that they assist in the spread of the disease.

That all areas are not equally infected is obvious also from a study of the map, but whether this is due to the absence of the intermediate host, or to the fact that the different tribes of natives do not intermingle to any extent, is not known.

Seventeen cases of schistosomiasis have been mentioned, 16 occurring in the larger Government "kuttab" or school, and one in the smaller "khalwa" (school) which was only Government aided, and which contained the smaller children who hailed from Talodi itself.

An analysis of these 17 cases shows the scattered nature of the infection also. Of these cases one was a case of *S. mansoni* infection and the patient probably obtained his infection in the White Nile Province at Ed Dueim, which has already been referred to as an endemic area for schistosomiasis in the Sudan. This was the only case which occurred among the smaller children.

Of the other 16 cases 10 came from the Kawahla district, 3 from the vicinity of Gebel Fungor, 2 from Eliri, and 1 from Kadugli, all of which places it will be seen from the map are bilharzia-infected districts. None of these cases actually came from Talodi itself, and it may be mentioned that no adults found to be infected in the province up to that time were ever traced to have caught their initial infection there.

This was probably because the water supplies in Talodi were obtained from two Government-controlled deep wells which were well protected and locked up when not in use. In addition efficient sanitary arrangements and methods of sewage disposal were enforced.

Although not found it is inconceivable that the intermediary hosts were not present in the neighbourhood.

It has been shown that the disease is amenable to treatment, but in large districts such as the Nuba Mountains Province, only half-developed, with a wild and rocky terrain, and with poor roads, it will be easily understood that it is not feasible to procure successful destruction of the elusive intermediate hosts.

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XII.

The methods of approaching the prophylactic problem, therefore, in an endemic area such as this would seem to be (*a*) therapeutic treatment of the infected individual; and (*b*) the gradual provision of pure and protected water supplies.

For (*a*) travelling hospitals with a trained staff would be efficient, or failing these the provision of bilharzia "teams." Each team should consist of a medical man with one or two orderlies trained in the giving and preparing of the antimony injections and able and willing to examine the dejecta for the parasite.

For (*b*) the gradual sinking of deep wells and the filling in or treating by chemicals of the isolated ponds and ditches, would seem to be the solution. It is realized that it would not be always feasible or possible to find sites where wells, able to provide sufficient water, could be sunk in all the infected districts. In districts such as these, attempts should be made to clear the vegetation and to train the banks of the available surface water supplies, and methods of therapeutic attack should be concentrated upon.

XIII.

It will be long before efficient sanitation and cleanly habits in regard to defæcating and urinating, although they are ideals to be encouraged and hoped for, will be adopted by the ignorant and savage peoples of districts such as this. Their racial suspicions, apathy and superstitions, will provide many disappointments for workers amongst them. Much difficulty will be experienced in getting some of the people, especially the women and children, to submit to treatment and complete the course of antimony injections.

But, with a remedy such as tartar emetic, or its organic or inorganic compounds, to hand together with an enlightened Government policy and the gradual spread of education, the future in regard to the control and elimination of the disease is not unhopeful.

Acknowledgments.

My thanks are due to the Director of the Sudan Medical Services, and to the Principal Medical Officer of the Sudan Defence Force for kindly allowing me to make use of available material and the statistics quoted.

I acknowledge most gratefully the assistance received from Major G. K. Maurice, D.S.O., M.C., R.A.M.C., Principal Medical Officer, Sudan Defence Force, who kindly supplied me with maps in connection with the spread of schistosomiasis in the Nuba Mountains, and from Major R. G. Archibald, C.M.G., D.S.O., Director, Wellcome Laboratories, Khartoum, who kindly supplied me with available data in connection with snail distribution in the Sudan.

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ADMINISTRATIVE WORK IN A GENERAL HOSPITAL IN WAR-TIME.

By FRANK S. HILL,

Late Staff-Serjeant, Royal Army Medical Corps (T.).

On the outbreak of the late war, a territorial unit, the 2nd London (City of London) General Hospital, took over the premises constituting St. Mark's College, King's Road, Chelsea, together with adjoining buildings and grounds. The college buildings were allocated as follows: The principal's residence became the officers' mess and quarters; the new portion of the college was utilized for medical wards, orderly room, and afforded office accommodation for the Commanding Officer and Matron, telephone exchange, etc. The older portion of the college premises was used for medical wards, quartermaster's stores, and provided accommodation for the registrar's office and discharge office. The large college dining hall was used as a nurses' dining hall. Behind the college, in 1914, were green lawns and tennis courts that later were covered with long hut-wards. The junction railway that runs by the side of the college grounds afforded access to the hospital premises, gates from one platform opening into the grounds. In the early stages of the war, hospital trains were unloaded here, but the time occupied blocked this most valuable artery line for too long a period, and subsequently the sick and wounded were brought from the big London termini in ambulances and cars. The buildings known as St. Mark's Schools, facing Fulham Road, housed the R.A.M.C. (T) Staff during the early days, but later were used as a "convalescent" block and by patients awaiting discharge. The handsome St. Mark's Church provided an excellent hospital church. A short road on the eastern side of the college property, known as Hortensia Road, leads through from King's Road to Fulham Road, and on one side of it stood the main Surgical Division and the Officers' Hospital, both housed in L.C.C. Secondary Schools. On the vacant land that lay on the farther side of this road, long runs of huts were erected for surgical cases. Great gates were erected at each end of Hortensia Road, and as a general rule convoys entered by the King's Road, and, having been unloaded, left the hospital by way of the Fulham Road gate. A large hospital kitchen, additional quartermaster's food stores, etc., were built in the grounds, and a two-storeyed building (formerly a laboratory) formed a mess-room for the R.A.M.C. on the ground floor, and provided accommodation on the upper floor for the serjeants' mess. These premises, collectively, formed an almost ideal temporary war-time hospital.

Upon the outbreak of hostilities, the unit, under Colonel Callender,

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immediately prepared the different premises for their various purposes; it was a case of "all hands on deck," if one may employ a nautical expression in connection with a military matter; everyone from the C.O. down to the latest recruit worked at high pressure to prepare for the hundreds of expected patients.

The hospital soon settled down to routine work. A large Y.M.C.A. hut was built, and other items necessary to the happy running of a hospital were added. Excitement among the staff was occasionally roused by a call for volunteers for nurses and orderlies for a hospital ship; these calls always resulted in a scramble among the fit to get selected. Subsequently Colonel Callender went overseas, his place being taken by Major (later Lieutenant-Colonel) C. A. Lees, who also proved to be a highly-popular C.O. The hospital was soon ear-marked as an "Eye" hospital in addition to its ordinary work; and cases sent to London to enter St. Dunstan's were first transferred to the "2nd London." Across the grounds that now separate the larger of the two County Council Secondary Schools from the rear of the old quarters of St. Mark's College, was built a covered-in passage-way, up and down which the many blinded soldiers first learnt to "feel their way" before going on to St. Dunstan's where, thanks to the splendid work of the late Sir Arthur Pearson, they were trained in useful occupations.

The course of the war and the varying seasons of the years were reflected in the types of cases admitted. At one time frost-bite brought crippled men; at another, gas and liquid fire were responsible for a new variety of hospital patient. Men came from far-away Mesopotamia, from Gallipoli, of tragic yet heroic memory, from Africa, and, relatively near-by, Flanders.

In later years sleepless nights were occasioned by air raids. On receipt of what was known as "Field-Marshal's Warning," a hospital ambulance had to be dispatched to the nearest ambulance rendezvous, while the staff "stood-by" at fire appliances and other posts. The perfect sang-froid of the C.O. on these occasions was typical of the proverbial coolness of his countrymen; for, however loud or near—and they were sometimes very near—the explosions might be, Lieutenant-Colonel Lees, on occasions, would make his calm, unhurrying, perambulation of the hospital. The continuation of hostilities brought an increase in the number of beds attached to the main hospital, e.g., Red Cross Hospitals in London and in the Home Counties; Fulham Palace, with its spacious lawns and rose gardens lent by the Bishop of London proved an excellent hospital for "leg" and "cot" cases; wards at the then Great Northern Hospital, Holloway Road, and at St. Andrew's Hospital, Dollis Hill, were among others attached to St. Mark's College. Later, those good men and true, the Freemasons, took over and equipped the Hospital in Fulham Road (which they now maintain there for sick brethren), and this, too, was placed under the administrative control of the "2nd London." In this

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way the number of beds associated with the Hospital began to approach 2,000.

As the demands for men became more insistent, frequent T.M.Bs. thinned out the ranks of the R.A.M.C. until at last approximately only one-half of the proper number of men was left, the places of the remainder being filled by women orderlies whose services were only available during the day-time. Experience proved that the employment of these "part-timers" is only justifiable by reason of the great shortage of man power.

There is no available space, nor is there the need, to trace the history of the war as reflected in the detailed life of the hospital; but the effect of the news of the Armistice is worthy of record. Patients who had been unable or forbidden to leave their beds, by almost superhuman efforts got up in an attempt to join the great crowd of excited patients; some of these feeble men tumbled down stairs in their efforts to take part in the jubilations. An impromptu service was forthwith held in the church—probably the most remarkable that has ever been held within its walls, certainly no gathering could possibly ever have been more fully attended.

In the early months of 1919 wards began to be closed down as the stream of sick and wounded dwindled; and ultimately the remnants of the unit vacated the various premises. Like other hospitals of a temporary war-time nature, there was no great closing day; the premises quietly returned to their peace-time occupation; and once more the grass grows where stood the long runs of huts full of suffering humanity, and smiling peace broods over the quiet grounds that lie hidden from the public gaze between King's Road and Fulham Road.

Looking back over those strenuous years one recalls certain outstanding administrative features that might with advantage have been improved upon. For example, it would appear that, since the work of a registrar was similar to that of the secretary of a peace-time civilian hospital, some arrangements might have been made whereby, before the outbreak of hostilities, secretaries and their assistant secretaries of large hospitals, might have been invited to take up commissions in the R.A.M.C. to act as registrars. The inevitable shortage of medical men in the Army would, to a small degree, have been minimized and the temporary innovation would have been justified, since the value of one doctor more in the field is incalculable. From the practical working out of things it would seem that the fact that such a registrar was a layman would not seriously handicap his work, for even if the registrar be a medical man, professional etiquette precludes his interfering, clinically, to any appreciable extent with the patients or their diagnosis. Similarly, endeavours might have been made to recruit certain members of the clerical staffs of civilian hospitals (men) into the R.A.M.C. (T.), and women into the B.R.C.S. with the object of detailing them for clerical work in the offices of registrars of general hospitals in war-time. It would also have been advantageous if both men and women clerks in the departments of medical officers of health could

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have been trained in peace-time for service in registrars' and wardmasters' offices.

Another point that was noticeable was that the clerical work in wardmasters' offices, excepting in so far as it related to discipline, in which case the connecting link is the orderly room, could be more closely associated with the registrar's office; were this done duplication of work would be further avoided. Probably the best arrangement is for the registrar's clerk to be appointed as the senior N.C.O. over the two wardmasters.

In addition to the official "A and D" book, it was found in practice to be very useful to keep a separate "Discharge" book, in which the records were kept of each day's discharges, transfers to convalescent hospitals, etc. Such a register is the chronological counterpart of the "Admission and Discharge Book" and need only contain the minimum amount of information provided a suitable reference be made to the corresponding entry in the "A and D" book. This cross-reference would be extremely useful and could be quite simply maintained if provision was made for each entry in the "A and D" book to be numbered. A "Discharge Register" might well be made an official book. The question is worth considering whether a separate "A and D" book for each separate Expeditionary Force is desirable. With many field forces employed, if there is a register for each one, there is no one complete book containing hospital admissions arranged in chronological order. The necessary information relating to the field force concerned could be entered in a separate column, and complications, such as when a soldier is returned to hospital from one force on account of injury or sickness contracted in an earlier one, would be obviated, e.g., a patient returned from Flanders suffering from an attack of malaria originally contracted in Asia.

One of the most useful adjuncts to a registrar's office is a card-index of patients. Usually a 3 inches by 5 inches thin card is all that is required, with "guide" cards for the alphabetical divisions. The following is a specimen of the card used at the 2nd London :—

No. 111.	L/Cpl. Percy Brown	Ward 1
	1st Mx.	
	France	
1/1/16	Overseas Convoy	C.E.
	G.S.W. rt. thigh	
1/4/16	trans. Red X Hp., Richmond	
22/4/16	10 days' furlough	

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Two separate boxes about 2 inches high are all that is necessary, one for in-patients including those in convalescent beds and one for discharged or transferred patients. On receipt of lists of men marked up for discharge, etc., each man's card can be picked out and reference made to any instructions thereon. After each morning's discharges these cards should be suitably endorsed and filed away in the box relating to discharged patients. The hospital postman, i.e., the soldier distributing the post should have easy access to this card register or to those in the wardmaster's offices; in the case of large hospitals he may profitably make his own card-index. Where instructions of an important nature are received and it is not thought desirable to file those communications with the ordinary correspondence, then they may be attached to the man's card. It is a useful check if these cards are again examined at the time each man parades for discharge, in order that it may be ascertained if his discharge instructions agree with the condition under which he was admitted, e.g., short-leave men to return to the R.T.O., sick and wounded overseas men to their furlough, re-admitted expeditionary men to their depots or according to orders received, United Kingdom (U.K.) men back to their units, and so on. An additional precaution that was observed, and which was most useful at court martials in cases of deserters, was the practice of handing to every patient leaving hospital a buff slip on which were typed his description, the date and reason for his admission to hospital, the date of his discharge, and the instructions given to him as to rejoining.

It was found to be a great advantage to order men for discharge, transfer, etc., to parade at the discharge office during the afternoon of the day preceding their leaving hospital, so that all their particulars might be checked over in the hospital records. All that remained on the morning of their departure was to parade them for discharge and to hand to them their documents, railway warrants, etc.

It may at first sight appear that some of these details are too insignificant to be arranged before an outbreak of hostilities, in the assurance that "things will work out all right"; but one paramount lesson of the last War was that of the still greater need for attention to detail and preparedness. It has been said, with a great amount of truth, that the strength of a chain is the strength of its weakest link, and this is the axiom to bear in mind when making arrangements for a possible time of stress and trial. It is quite as necessary to apply business office methods to the routine office work of a hospital as it is to employ these methods in commercial offices in peace time, perhaps even more so, and it should, therefore, be considered no more unnecessary to train territorial R.A.M.C. men in this branch of work than in any other. During winter evenings it might provide a useful variation from stretcher drill, etc., to exercise men in the procedure of receiving and unloading a convoy, warding patients, checking their details from field medical cards, making appropriate entries in "A and D" books, handing over patient's field service kit into quartermaster's

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stores, parading patients for discharge, checking over regimental details, referring to their record cards and noting instructions thereon, dispatching medical history sheets, case sheets, medical board papers, and so on. The time spent in a military hospital or in camp during the period of summer training is short and it might well be supplemented in this manner on appropriate occasions during the year.

There are certain minor points that might be referred to that are of relative non-importance but which have a direct bearing upon the efficient conduct of clerical work and records, such as the need for adequate column space for making entries in books and forms, since these sometimes have to be completed by persons whose handwriting is none too small, or it may be that the disability is not a simple one and needs a fair amount of space in the column devoted to that subject.

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THE STORY OF OPIUM.

By Quartermaster-Serjeant ERIC F. SMITH,
Royal Army Medical Corps.

"I bring refreshment,
I bring ease and calm,
I lavish strength and healing,
I am balm."

Christina Rossetti.

To the layman opium suggests visions of secret illegal haunts in the Chinese quarter of great cities, where miserable wretches dope themselves to an ignoble end. To the lover of literature it has been the means of introducing some of the most wonderful writings, in the works of De Quincey, which have appeared in the English language. Its value is alone known to the physician and pharmacist, although they are fully aware of the dangers which attend its uncontrolled consumption.

Its history embraces many countries and periods, and is associated with some extraordinary episodes. Britain once possessed the world's monopoly in its trade, and lost it again at a great sacrifice. She was forced into an unjust war owing to its traffic, but gained a colony as the result of that war.

Opium is one of the oldest drugs known to medicine. As far as is known, it was first mentioned by Theophrastus (390—280 B.C.), a disciple of Aristotle, who refers to it as an extract produced from the whole of the poppy plant. Dioscorides, an early Greek medical authority, in A.D. 77 differentiates between one extract obtained from the whole plant, and another, which he called *opion* (derived from Greek *opos*, vegetable juice), obtained from the capsule. It was Heraclides, one of the Empirics, who lived in the third century of the Christian era, who first recorded the use of opium as an anodyne in painful diseases. His prescription for cholera was composed of henbane seeds, aniseed, and opium. Galen, however, seems to have been somewhat dubious about using the drug, probably owing to his ignorance of its composition, and states that he never employed it except *in extremis*. In 1516 opium was first referred to as the product of Cous (Kuch Behar), and its cultivation in India was solely due to the Mahomedan invasion of that country. The first Islamic conquerors arrived in India about A.D. 1200, but it is not certain when the white poppy was first planted. About the middle of the fourteenth century the Mogul emperors were in receipt of a large revenue as the result of its exploitation, and they retained the world's opium trade until it was wrested from them by Clive's victory at Plassey in 1757.

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That extraordinarily revolutionary character, Paracelsus, to whom the writer has referred more fully in a previous article,[1] introduced an *anodynum specificum*, which was prepared by digesting opium, 4 parts, in a mixture of orange and lemon juices, 180 parts, with distilled frog's spawn water, to which cinnamon, 4 parts, cloves, 45 parts, ambergris, 4 parts, and saffron, 45 parts, were added. The mixture was digested for a month, and after pressing and straining, coral, magistery of pearls, and quintessence of gold, of each 2 parts, were added. A weird and wonderful prescription, which is worthy of the brain of Paracelsus. He also used a substance which he called "laudanum," but it is doubtful whether there was any opium in its composition, at any rate there is no prescription left on record. "Ich habe," he writes, "ein Arcanum, heiss ich Laudanum, ist uber das alles wo es zum Tod reichen will." There are several theories advanced to explain the origin of the word. One is that it came from labdanum, a resinous exudation from a shrub (Linnaeus—*cistus creticus*) growing on the island of Candida. This was collected in a somewhat unusual manner. The goats of the island, which browsed on the hills, when they returned to the fold at night, had their beards combed by the islanders for the purpose of removing the resin. Dr. La Wall is, however, of the opinion that this theory is erroneous, and that the one given by Quercetanus, the name adopted by Joseph du Chesne, a mediæval pharmaceutical writer, is probably right. The latter states that the root word is *laudare*, to praise, and was applied to the compound owing to its praiseworthy nature.

For more than a century after Paracelsus, the word laudanum was applied to solid preparations, some containing opium, others not. The first edition of the London Pharmacopœia (1618) contained several formulæ, under the title of *Laudanum*, but these all contained opium.

Van Helmont (1577—1644), a Flemish pharmacist, and an ardent admirer of Paracelsus, was so impressed with the potency of opium that he prescribed it in large doses at every possible opportunity, so much so that he came to be known as the "Doctor Opiatus." Stahl (1600—1734), a German chemist, and the originator of the phlogiston theory, which was not disproved until the advent of Lavoisier and Humphry Davy, disapproved of the use of opium in any form. He was the author of a treatise, "De Imposturis Opii," and in it he severely castigates Van Helmont and the school of Paracelsus for presuming to use a drug of which they knew so little.

Dr. Thomas Dover (1660—1742) will ever be associated with the diaphoretic powder which bears his name. He seems to have received only a slipshod medical education, but he attended, spasmodically, the lectures of the great Dr. Sydenham. In 1708 he was captain of a privateering

[1] "The Story of the British Pharmacopœia," JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, vol. L.

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vessel, the "Duke," and his ship in 1709 rescued, from the island of San Fernandez, that Alexander Selkirk whose adventures inspired Daniel Defoe in later years to write his romantic masterpiece. Dover's voyage ended in 1710, with great profit to himself, thereupon he abandoned the sea for medicine, and in a short time became successful and popular. In 1733 he wrote "The Ancient Physician's Legacy to his Country," which contains an account of the various remedies he applied during his medical career. The "diaphoretic powder" on which his fame stands he describes as follows :—

Opium Ipecacuanha Liquorice in fine powder	of each one ounce
Saltpetre Tartar vitrolated	of each four ounces

This was directed to be taken in sixty-grain doses, but Dover states that he often gave up to one hundred grains.

Dr. Thomas Sydenham (1624—1689), under whom Dover studied for a while, was a conscientious and capable physician. He placed great faith in the efficacy of opium, and was the first to introduce the alcoholic tincture into general practice. This he prepared, mixed with saffron, by percolation with Canary wine. He first described the tincture in 1669, which he employed as a specific for the victims of the Great Plague which devastated London in 1664. "I do not believe," he wrote, "that this preparation has more virtues than the solid laudanum (opium) of the shops, but it is more convenient to administer. . . . Of all the remedies which a kind Providence has bestowed upon mankind for the purpose of lightening its miseries, there is not one which equals opium in its powers to moderate the violence of so many maladies, and even to cure some of them. Medicine would be a one-arm man if it did not possess the remedy. Laudanum is the best of all the cordials, indeed it is the only genuine cordial that we possess to-day."

Despite the conscientious labours of Sydenham it was left to a quack to popularize opium by means of the diaphoretic powder of Dr. Dover.

Joshua Ward (1685—1761) commenced life as a drysalter. It is doubtful whether he ever received any medical training whatever, but he possessed a fascinating personality, and enjoyed the friendship of such well-known men as Gibbon, Fielding, Reynolds, Horace Walpole, and Churchill, and in a short time he rose to be one of the most brilliant figures in that glittering coterie. Ward, by a lucky move on his part, managed to reduce the dislocated thumb of George II, and thereby gained the everlasting friendship of that monarch. By 1748 he had attained such fame as a physician (*sic*), that when an apothecary's Act was introduced by Parliament "to restrict unlicensed persons from compounding medicines," he was especially exempted by a clause which was introduced at the last moment. Many of his prescriptions were published at the expense of the royal purse, but he was an arrant plagiarist, and one of his specifics was

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nothing more than Dover's powder, which he introduced to the world as his own composition under the name of "Sweating Powder." It first appeared in the London Pharmacopœia for 1788.

Ward's name has been handed down as the inventor of Ward's paste, the confectio piperis of the British Pharmacopœia. He had great political ambitions, and was at one time returned as M.P. for Marlborough, although Parliament unseated him, as it was found that at the alleged election he did not receive a single vote. Pope wrote of him :—

> "Of late, without the least pretence to skill,
> Ward's grown a famed physician by a pill."

The paregoric (tinct. camph. co.) of the present B.P. orginated with Dr. Le Mort, Professor of Chemistry at Leyden University (1702—1718). His formula was published in the London Pharmacopœia of 1721 under the title of *Elixir Asthmaticum*, and contained honey, liquorice, opium, benzoic acid, camphor, oil of anise, potassium carbonate and alcohol. In later editions it came to be called *Elixir Paregoricum*. The origin of the word paregoric is interesting. It comes from the Greek word *paregorein*, to address a meeting. Later the word came to indicate the act of pacifying an audience with soft words, and in due time was applied to any soothing draught. Paregoric was originally used in pharmacy in connection with a variety of preparations. In the Pharmacopœia Universalis, published at Weimar in 1846, over twenty different kinds of paregoric are referred to, all of them containing opium.

India and the Opium Trade.

Ever since the Battle of Plassey (1757) the Empire's trade in opium has been the subject of much controversy and misunderstanding. Palmerston, in a letter to Lansdowne written in 1850, said, "No doubt for valuable cousideration we could prevail upon our friend the Czar to take us under his wing, and his conditions would probably be acceptable to many, as he would most likely be satisfied with being allowed to relieve us from the sin of selling opium to the Chinese."

A certain section of public opinion at home, through ignorance of the actual prevailing conditions in India, had accused the British East India Company of practically forcing opium down the throats of an unwilling nation for the benefit of the shareholder's pockets. As has been pointed out again and again by those who know, there are no "drug fiends" in India. Opium was partaken of sometimes medicinally, sometimes socially, when it was offered as an act of hospitality, and more often in small quantities as an indulgence, but never to the extent of excess as it is sometimes taken in the West. To quote from the Official Handbook on India: "For over a century the authorities have been engaged in the gradual establishment of control over the production, transit and sale of the drug throughout the country. This has been done by concentrating the cultiva-

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tion, as far as British India is concerned, within limited areas, by the discontinuance of cultivation in many Indian States as the outcome of bargaining, and by a perfect system of licensing and control of shops. The success of this policy is proved by the results. . . . Enhanced prices and restricted supply, together with a welcome, though slow, trend of public opinion, are resulting in a decreasing use of opium for ceremonial hospitality or for personal indulgence, and thus are tending to restrict the consumption of the drug to purposes either medicinal or *quasi*-medicinal."

In 1891 Sir John Pease introduced a resolution, which was adopted by the House of Commons (by 160 to 130), condemning the cultivation of opium in India. The Pease resolution was the result of continued agitation on the part of a certain minority of public opinion, but the powers of minorities in England have always been extraordinary.

As a sequel to this resolution a Royal Commission was appointed in July, 1893, which recommended that prohibition should not be enforced, but suggested State supervision. The report was adopted.

China for many years was India's best customer as regards the sale of opium. The Chinese Royal Edict of 1796 forbade the import of opium, with the result that the British Government adopted the policy of excluding opium ships from China, and at Canton and Macoa placed superintendents, who were, however, biased to such an extent in favour of their own countrymen, that traders became bolder and bolder and landed large supplies of the crude drug under the very noses of the Chinese officials. In 1839 the Mandarins at certain places destroyed quantities of the smuggled opium, in accordance with instructions received from the Emperor, and this led in 1840 to the so-called "Opium War" between Great Britain and China, not a very creditable affair for us, but the treaty ending hostilities ceded Hong Kong to Britain, and caused the establishment of the "Treaty Ports."

On February 1, 1909, at Shanghai, China, the United States, Great Britain, Austria-Hungary, France, Germany, Italy, Japan, Holland, Persia, Portugal and Russia, entered into a bond, and resolved that it was the duty of their respective Governments to prevent the export of opium to any countries which prohibited its import. The British Government had gone a step further two years earlier by making an offer to reduce the export of Indian opium to countries beyond the sea by 5,100 chests each year until 1910, and that if during these three years the Chinese Government had carried out its avowed intention of reducing the production and consumption of the drug within its borders, then the British Government would undertake to cease supplying China with opium in ten years from 1910.

India therefore sacrificed a former revenue of 4,000,000 sterling per annum, and the irony of it all is that *China now produces something like eighty per cent of the world's opium growth.*

The use of any suitable variety of opium is officially permitted for preparing the tincture and the extract, provided it contains not less than

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7·5 per cent anhydrous morphine, but opium for other official purposes must contain between 9·5 per cent and 10·5 per cent.

Turkey opium, or the variety known as "Druggist's," contains from 12 to 15 per cent of morphine, whilst Indian medicinal opium contains much less, viz., 7 to 9·5 per cent. For this reason Indian opium is not employed for pharmaceutical purposes, but is used, as is inferior quality Turkey, for the extraction of the alkaloids. In British India the cultivation of opium is only permitted under Government license, and on the understanding that the whole of the output is sold to the Government factory at Ghazipur, United Provinces, at a fixed rate.

At the Ghazipur three classes of opium are manufactured :—

(*a*) Provision opium, intended for export.

(*b*) Excise opium, for home consumption.

(*c*) Medicinal opium for export to London, and for supply to the Medical Department of India.

The standard of Indian opium could be raised. Professor Greenish, Dean of the School of Pharmacy, and our greatest authority on the cultivation of drug plants, stated on one occasion that if proper methods were adopted, Indian opium would be as rich in alkaloids as that produced by other countries.

The author acknowledges the courtesy of Messrs. Burroughs Wellcome, Ltd., in supplying him with some interesting details regarding Indian opium, which have been embodied in this article and in a previous article on "India and the Opium Trade" which appeared in the *Times of India* recently.

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Editorial.

THE VALUE OF THE VARIOLA-VACCINIA FLOCCULATION TEST IN THE DIAGNOSIS OF SMALLPOX.

THE difficulty of diagnosing smallpox in the early stages of an outbreak, when attention has not been drawn to the possible existence of the disease, is well known. For the control of an infectious disease early diagnosis is of paramount importance, and this is especially the case when the prevalent type of smallpox is so mild and so closely resembles chickenpox that even experienced observers have confounded the two diseases. While the type of smallpox is mild a mistake in diagnosis may not be very serious, but when an early case of severe smallpox is mistaken for chickenpox the consequences may be disastrous.

For the control of smallpox in a population incompletely protected by vaccination prompt notification of cases is a measure of incalculable importance, but efficient notification is impossible without early and accurate diagnosis.

In 1925 Dr. M. H. Gordon found that the agglutinating antibodies in anti-vaccinia serum prepared from the rabbit exhibit as great an affinity for the virus of variola as for that of vaccinia, and therefore have a practical application for identifying the presence of variola virus in material derived from the pustules of cases of smallpox. The reaction is specific and sharply differentiates the virus of vaccinia, or variola, from that of chickenpox. Dr. Gordon thought that this comparatively simple agglutination reaction would afford material assistance in the diagnosis of those suspected cases where the atypical nature of the clinical picture caused difficulty in arriving at a correct diagnosis without delay. Dr. Gordon found that suspensions of scabs from five outbreaks of smallpox, including three of alastrim, agglutinated with anti-vaccinia serum. Later he received fresh material from an outbreak of alastrim at Ashington, Northumberland. The material consisted of mixed scabs from a number of cases, scabs from a case with a developed eruption, and scabs from a case about which there was a difference of opinion, some considering it a case of alastrim. The mixed scabs and the scabs from the case with developed eruption gave positive agglutination results with anti-vaccinia serum diluted 1-40, but no reaction with normal serum. The doubtful case gave entirely negative results.

An outbreak of smallpox at Dundee in 1927 gave a further opportunity of testing the value of the agglutination test. In this work the Medical Officer of Health, Dr. Burgess, was associated with Professor Tulloch and Dr. Craigie, of the Department of Bacteriology in the University of St. Andrews.

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The Medical Research Council have published their investigations, which support the work of Dr. Gordon.

The history of the outbreak of smallpox at Dundee shows once again the failure to recognize cases by medical practitioners of average experience of the disease. There were eleven cases admitted to hospital with the provisional diagnosis of smallpox, all of which proved not to be suffering from that disease. It was early realized that a test which would enable smallpox to be distinguished from chickenpox would be of great value. Owing to the limited amount of agglutinating serum available, the bacteriologists were able to apply the agglutination test, or, as they prefer to call it, the flocculation test, in only a limited number of cases. But as this is the first occasion in which the flocculation test has been applied to a significant body of clinical material, the writers feel justified in publishing their results.

There were 152 known cases, and all were of the so-called mild type. The source of infection of the outbreak was not definitely established, but there is definite evidence that the infection was in the city for at least a month before the fact was known.

The cause of the failure to recognize the disease was the mild type, and it was not until a more severe case, having the classical symptoms of smallpox, occurred that the existence of the disease in the city was placed beyond doubt.

The writers say that real difficulties did exist in the diagnosis of cases, and one at least of those seen by them in consultation before the existence of the disease was definitely established was diagnosed chickenpox, though it afterwards turned out to be smallpox. In twenty-five per cent of the cases there was no prodromal period of three days' illness; the rash was also meagre, so that its distribution was useless for diagnostic purposes. Moreover, the character of the lesions and mode of development did not help, and often simulated chickenpox. In one district, where very few of the children were vaccinated, eighteen cases which were subsequently found to be smallpox were notified to the M.O.H. as chickenpox.

The supply of vaccinia agglutinating serum being limited, and only obtainable through the kindness of Dr. Gordon, the test was employed chiefly in cases with suspicious but indefinite signs, particularly if they occurred in districts of the town situated at some distance from known centres of infection. In many of the cases the flocculation test actually constituted the deciding factor in determining the action to be taken. The writers state quite definitely that the assistance so obtained was of such value that they are convinced that the test is a reliable one and can be used with confidence as an aid to the diagnosis of smallpox.

Professor Tulloch and Dr. Craigie, during the course of their work, noticed on four occasions that when crust extracts were exposed to rabbit serum, both anti-vaccinia and normal, very large loose flocculi formed within an hour at 55° C. These flocculi were easily dispersed and were

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quite different from the small masses of clumped material which characterize positive tests. This pseudo-reaction might be a little disturbing to anyone not accustomed to the test. The cause of the pseudo-reaction is being investigated so as to determine the factors on which it depends and with a view to eliminate its occurrence.

Tulloch and Craigie think it is not improbable that the vaccinia flocculation test more closely resembles a precipitin than an agglutination reaction. They consider that in preparing the immunizing antigen the possibility of precipitin formation due to the introduction of a *foreign* protein should be rigorously excluded. When rabbits are used as the source of the immune serum, the suspensions of vaccinia crusts used to immunize them should be derived from rabbits, and if the serum is to be employed for a scientific investigation the vaccinia should have been passed *three* times through rabbits. If the serum is to be used only for the diagnosis of human material, then it is possible that one passage of bovine vaccinia through the rabbit may suffice. The serum used in the test must be quite clear, otherwise it is difficult to see the fine floccules formed in the reaction. The extracts prepared from the crusts must also be only *faintly* opalescent. The problem is to secure the maximum of flocculable substance with a minimum of extraneous matter.

Tulloch and Craigie admit that owing to the presence of micro-organisms, mainly staphylococci, in the skin of a rabbit, suspensions of vaccinia crusts from that animal may, on inoculation, call forth antibodies to the staphylococci as well as to the vaccinia.

Schultz, Bullock, Laurence and Brewer, writing in the *Journal of Immunology*, maintain that the positive flocculation results obtained with anti-vaccinia serum and suspensions of vaccinia crusts are due to the secondary micro-organisms in the crusts reacting with the antibodies called forth by their inoculation, and are not due to the formation of a specific complex of vaccinia virus and its specific antibodies.

In order to eliminate these secondary invaders, Schultz, Bullock and Laurence immunized rabbits with a strain of "brain" vaccinia virus. They compared the serum so obtained with that resulting from the immunization of rabbits by means of vaccinia crusts, and say "It may be stated at once that no evidence whatever of the presence of specific precipitins against the virus could be elicited by these tests. While a faint ring was sometimes noted when the anti-sera were tested against extracts of virus brains, the same reaction occurred in the presence of normal rabbit brain, and likewise when the corresponding normal sera were so tested. On the other hand, more clearly-defined results were sometimes obtained with immune sera against cutaneous vaccinia when these were tested against extracts of cutaneous vaccinia pulp. The specificity of these reactions may justly be questioned, since these immune sera also reacted to a similar degree with bacterial extracts prepared from organisms which had been cultured from cutaneous vaccinia pulp."

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Tulloch and Craigie observe that if this explanation of the reaction be accepted, it must be assumed that the same secondary invading organisms are present in fifty-three cases of smallpox and ten strains of vaccinia from three different animal species, and that they are constantly absent from varicella crusts and scabs from septic rashes.

It is of course possible that there may be a specific secondary invader developing along with vaccinia and variola in the skin of different species of animals, but so far they have recovered from such material only the normal inhabitants of the skin.

They have made quantitative estimations of the bacterial flora of crusts (practically all staphylococci of the *albus* type) derived from vaccinia rabbits, and used for the preparation of stock vaccinia pulp. They find that although anti-vaccinia serum may contain antibodies to secondary infecting bacteria, crust extracts, as usually prepared, do not contain sufficient of the bacterial antigens to give rise to a precipitate in the presence of such serum. Moreover, exudates known to contain large numbers of staphylococci have been extracted in the same manner as vaccinia and variola crusts, and in the hands of Gordon and others have consistently failed to give positive results with anti-vaccinia serum.

In order to confirm their previous results with the bacterial flora of vaccinia crusts, Tulloch and Craigie made cultures of secondary invading bacteria from four different sources and mixed the growths in equal proportions, after which they were dried and triturated in the same manner as the extracts from vaccinia crusts. But the suspended product was not centrifugalized, so as to make certain that the suspension contained a maximum of the bacterial antigen. The product so obtained was tested against six different samples of anti-vaccinia serum derived from rabbits, the series of concentrations of the bacterial antigen covering the whole range of staphylococcal contamination which might be present in vaccinia rabbit crusts as prepared by them. There was no evidence of precipitation of any of the suspensions of the staphylococci by the anti-vaccinia serum or by normal rabbit serum. The control vaccinia crusts, however, gave a reaction with each serum. These results confirmed the previous experiments, and it seems extremely improbable that the flocculations observed with vaccinia and variola crusts are due to the mechanism suggested by Schultz and his co-workers.

As a result of further work, Tulloch and Craigie thought that invisible (a microscopical) agglutination or precipitation might occur. They then tried the effect of absorbing the vaccinia flocculating serum with a mixed whole culture of secondary staphylococci invaders, and found that the agglutinating antibodies for the staphylococci were removed, but the flocculating power of the serum for the extracts of the crusts from which the staphylococci had been obtained remained intact.

They write, "As the bacteria used for absorption were derived from the crusts whose extract still flocculated in presence of the absorbed serum, and

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also as the normal serum, while agglutinating the bacterial suspension, fails entirely in the same concentration to flocculate the extract of vaccinia crust, it would appear that the vaccinia flocculating property of this serum is not due to the presence of antibodies to the secondarily infecting micro-organisms."

The degree of bacterial contamination of the extracts prepared for flocculation tests can be determined by direct microscopical examination. Floccules when stained with carbol-fuchsin and so examined are seen to be composed of amorphous material and lack the definite morphology of micro-organisms. The photographs prepared by Tulloch and Craigie show that if bacteria are present in vaccinia suspensions, they either represent only a very small fraction of the material or have lost completely their morphological characters and staining properties.

It has been suggested that though precipitates may form when anti-vaccinia serum is brought in contact with extracts of crusts from variola or vaccinia, we do not know what really happens in the process of flocculation, and the reaction may be quite different from that which occurs in bacterial agglutination or serum precipitin tests. Tulloch and Craigie admit that though the flocculation may be specific and sufficient for diagnostic purposes, it does not follow that the precipitum consists of a complex formed by union of specific antibody with vaccinia virus. They say it is possible that the precipitate consists mainly of the globulins of the anti-serum within which is entangled epithelial debris to which the virus is adsorbed.

It has been further suggested that the reaction is really of an heterogenetic nature and akin to the Wassermann test. But if this be so, then infection of the epithelium of man, ox, or rabbit, with variola-vaccinia virus, must cause the production of the same heterogenetic antigen, for neither the normal epithelium of animals nor human epithelium infected with varicella or with staphylococci gives positive reactions. Tulloch and Craigie regard this explanation as improbable, though not impossible, and state in the conclusions of their report that with our present knowledge it would be safer to regard the reaction as being due to the union of antigen (vaccinia or variola) with true antibodies to the virus, and that the floccules which appear are due to this union. The floccules may be rendered more demonstrable by entanglement of epithelial debris to which the virus adheres.

Whatever may be the explanation of the phenomena observed in the flocculation test, we think the evidence now obtained has placed the value of the test in the diagnosis of smallpox beyond reasonable doubt, and that administrative measures for the control of the disease may safely be based on the results obtained with the flocculation test.

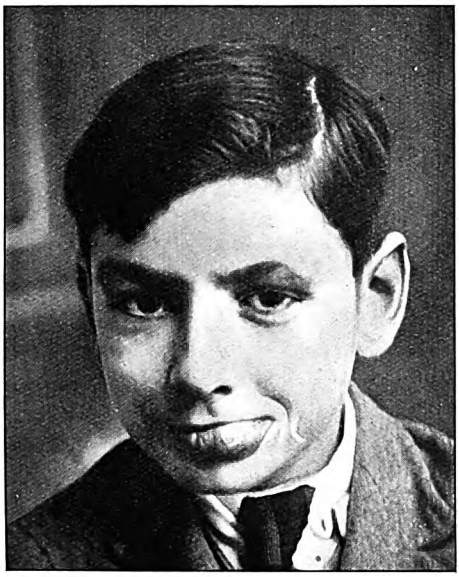
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Clinical and other Notes.

QUININE-URETHANE SOLUTION IN THE TREATMENT OF ANGIOMA.

By Major W. T. GRAHAM, O.B.E.
Royal Army Medical Corps.

The treatment of nævi by the injection of sclerosing solutions is by no means a novel procedure. Reference to any of the older books on surgery shows this to have been practised before the discovery of electrolysis. Powerful coagulants of the blood were employed, such as iodine, pure carbolic, chloride of zinc and perchloride of iron. A considerable number of fatalities from embolism were recorded and the method rightly fell into disuse.



After the third injection.

Recently I was asked to treat a case of cavernous angioma of the lower lip in a boy aged 12. The tumour was so extensive that excision was out of the question. Not only were two-thirds of the lip involved, but also the mucous surface of the cheek and the gum on the affected side. During cold weather, or when the boy became excited, the swelling assumed very large proportions, and so alarmed the patient and his parents that the fear of injury, with consequent hæmorrhage, prevented him from taking part in any outdoor games.

Injection treatment was commenced with the stock solution used in

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the treatment of varicose veins (Génévrier's solution). The needle was entered through sound skin near the margin of the tumour. In all some fourteen injections were given during a period of six months. The dosage commenced with 0·5 cubic centimetre and was gradually increased to 1 cubic centimetre. On two occasions slight sloughing occurred on the inner side of the lip owing to the needle having approached too near to the mucous



At conclusion of treatment.

surface. The sloughs separated without giving rise to any trouble. There was a remarkable absence of pain throughout the treatment.

Another case successfully treated was that of a soldier with a small nævus on the glans penis. On this occasion two injections of 0·25 cubic centimetre were sufficient to effect a cure.

My cases are necessarily few owing to lack of material, but the method appears to be so simple and effective that it seems worthy of a more extended trial.

AN INTERESTING CASE OF IMPACTED FRACTURE OF THE RADIUS.

By L. F. RICHMOND, M.D., B.S.

The following case is, I think, instructive enough to deserve recording on account of the slight degree of disability caused and to show the necessity of having all doubtful cases X-rayed.

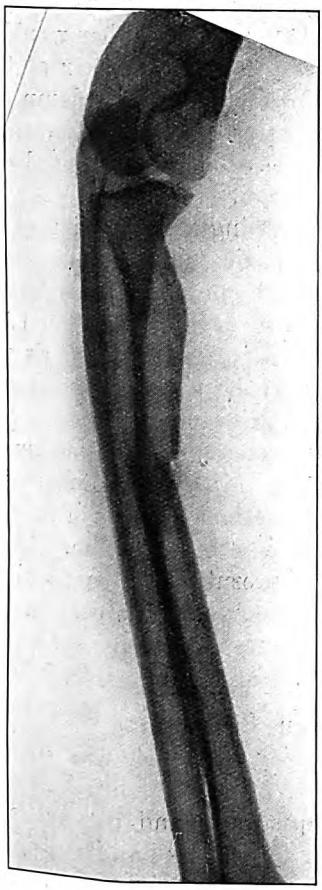
Private T. B., aged 20, a recruit in the Durham Light Infantry, while leaving the gymnasium one morning fell and injured his left arm; he did

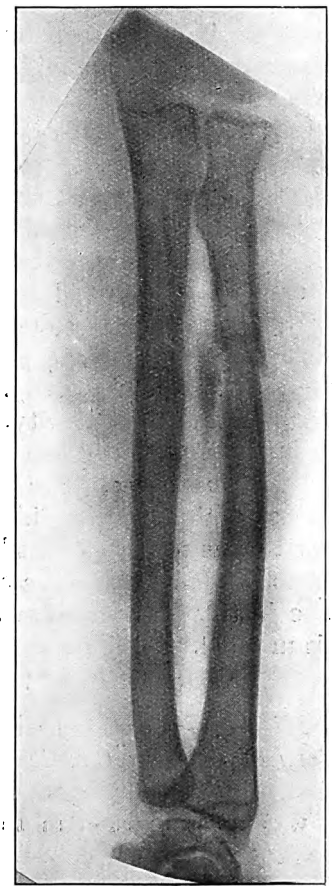
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not report sick and in the afternoon went on parade and carried out rifle drill.

On the following day he was sent sick. He complained of slight pain and loss of power over the middle third of the left radius.

On examination he was unable fully to pronate and supinate his left hand, and there was some tenderness over the middle third of his fore-arm, but no other signs of fracture. He was able without difficulty to lift and





carry a 14 lb. weight. The condition was thought to be due to a tearing of some of the fibres of the pronator teres muscle, but as the condition did not improve after a few days the fore-arm was X-rayed at the local hospital, and the film showed a comminuted impacted fracture at the junction of the middle and upper third of the radius. The alignment was very good.

The patient under suitable treatment made a good recovery with an excellent functional result.

I am indebted to Major J. J. D. Roche, R.A.M.C., Officer in charge, for permission to publish this case.

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ABDOMINAL SURGERY.

By Lieutenant W. G. S. FOSTER,
Royal Army Medical Corps.

The following case is published in order to demonstrate a recent advance in abdominal surgery. For years it has been the custom to adopt the Fowler's position and drainage in all abdominal cases where free fluid or pus is present in the peritoneal cavity. So forcibly has this form of treatment been impressed upon us that to suggest any other would appear revolutionary, yet Millar and Robertson in the *Practitioner* of October, 1928, have what one might almost call the audacity to condemn this old-time régime. After carefully considering their arguments I determined to give their method a trial. Here it may be as well to say a word or so on the treatment adopted by Millar and Robertson.

They hold that the original exudate following a perforation of the gut is toxic. They believe also that once the toxic source is eliminated, the original exudate is followed by a second which is not only sterile but antitoxic. Why then, they argue, attempt to drain such a fluid? They go on to say that tubes in the pelvis with the patient in Fowler's position will not drain the pelvic cavity. Fluid may be siphoned away but will certainly not rise against gravity. The great grievance against the presence of tubes is the undoubted fact that they encourage adhesions among the coils of small intestines. For these reasons Millar and Robertson have ceased to use drainage of any kind. Their method consists of mopping up all exudate, or as much as possible, at the time of operation. They then close the abdomen as in a clean case. Their results have been satisfactory enough to justify this procedure. We now come to the case on which I tried this method.

The Case.

Past History.—I could obtain no previous history.

History of Present Condition.—A soldier, aged 24, was admitted to hospital at Mhow, at 12 noon, complaining of abdominal pain.

This was most marked in the lower quadrants and was not localized. The attack had started forty-eight hours previously but the pain at that period had not been severe and was limited to the epigastrium. Twenty-four hours after commencing, the pain increased and involved most of the abdomen. The bowels had not acted at all during the attack.

Condition on Admission.—Patient complained of pain all over the abdomen. Temperature 100° F., pulse 84, respirations 20. He appeared a little flushed, otherwise normal. The abdomen was tender, more especially in the lower half and on the right side. There was a certain degree of rigidity more apparent at the umbilicus and in the right iliac fossa. I returned after three-quarters of an hour, during which time the operating theatre was prepared. The change in the patient was

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remarkable. The face was pinched and covered with sweat. Pain was severe all over the abdomen. Tenderness and rigidity were marked. The patient had vomited twice.

Operation.—The intestines were found to be firmly adherent to the peritoneum all over the anterior abdominal wall. It was only with considerable difficulty and care that the cæcum was reached. This was adherent to all surrounding structures and to the posterior abdominal wall. A hard structure, presumably the appendix, was felt to lie behind the cæcum. Having carefully packed off the intestines the pericæcal adhesions were separated. An abscess cavity was opened and several ounces of pus evacuated. This was carefully swabbed away and a much-enlarged gangrenous appendix removed. The abdomen was then closed in layers without any drainage. The general condition of the patient at the end of the operation was not satisfactory but improvement followed the administration of rectal salines. Pituitrin 0·5 cubic centimetre was given every four hours for thirty-six hours. By this time the bowels had moved twice. On the fourth night the patient was sitting up in a chair, and by the ninth day he was up all day. Convalescence was extremely rapid and uneventful.

Whether the case was a particularly lucky one I do not know. It is now three months since the operation, and last week the patient returned to duty.

NOTE BY MAJOR E. UNDERHILL, R.A.M.C., MEDICAL SPECIALIST MHOW DISTRICT.

I have been requested to add a note to the report of this case. I was present at the operation and can corroborate the findings. The report barely conveys a true idea of the difficulties met with owing to the dense matting together of gut to gut and to the abdominal wall by masses of tough adhesions. This point is one of some importance, as separation of adhesions was made only sufficient to expose and remove the appendix, and it is inconceivable that any drainage or even partial closure of the abdominal wall could have tapped more than a fraction of the pockets.

Having read Millar and Robertson I encouraged Mr. Foster in a trial of the method described because the authors appeared to me to have made out a *prima facie* case for their procedure on theoretical grounds supported by practical experience. In addition to the other considerations which Mr. Foster mentions, dramatic shortening of convalescence in this case as compared with those treated by the usual method would alone appear to justify an extensive trial of this method.

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FORENOTE ON AN ALTERNATIVE METHOD FOR THE ADMINISTRATION OF QUININE IN THE TREATMENT OF MALARIA.

By Major D. REYNOLDS, M.C.,
Royal Army Medical Corps.

It has probably occurred to many officers of the Royal Army Medical Corps that the present routine for the administration of quinine in cases of malaria can scarcely be considered scientific, owing to the drug being given usually without reference to the time of day at which the fever occurs, and to the long continuation of the treatment after all symptoms have subsided.

It is therefore possible that if more attention were paid to the hour of onset of the fever in each individual case, and the exhibition of the drug arranged accordingly, a method might be devised which, while giving equally effective results, would reduce considerably the quantity of the drug absorbed, with a corresponding diminution of its harmful effects.

On the advice of Lieutenant-Colonel W. W. Browne, O.B.E., Royal Army Medical Corps, Assistant Director of Hygiene, British Troops in Egypt, an experiment with thirty-five cases of benign tertian malaria was tried at Moascar, during last spring and summer, with this end in view. The underlying idea was to administer the quinine at a time when the malarial organisms would be most susceptible to its effects, and not to continue it during those stages when the probability of destroying parasites would be smaller. This appropriate time appears to be just after the rupture of the red blood-corpuscle has thrown the merozoites into the blood-stream and before they have obtained entrance into a fresh host.

The theory has been discussed at various times but I do not know that it has been given any serious trial.

Experiments have demonstrated that quinine appears in the blood twenty to thirty minutes after being taken by the mouth, and can be found there during the ensuing six hours, at most.[1]

Experience has shown that in any one individual the onset of fever in each exacerbation will occur at approximately the same hour; if, then, the administration takes place two hours before the expected attack, one can reasonably hope that when the merozoites are liberated into the plasma the quinine concentration will be sufficient either to destroy them forthwith or to reduce their vitality to such a degree that they will not be able to effect an entrance into a fresh corpuscle. By giving two further doses at four-hourly intervals, the blood should contain such a concentration of quinine for twelve hours that during this time the large majority, if not all, of the merozoites may be expected to have been destroyed.

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[1] "Practice of Medicine in the Tropics" (Byam and Archibald), vol. ii, chapter xxv p. 1633.

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The interval of twenty-four hours which then occurs, in the tertian varieties, is made use of for the exhibition of iron and arsenic, and two hours before the next attack would be expected, in an untreated case, the treatment is repeated.

A detailed account of the routine adopted is given at the end of this article. From this it will be seen that the course takes seventeen days, and after that time no further quinine is given, thus obviating the prolonged administration after discharge from hospital.

During the past hot weather thirty-five cases (two recurrent) in which benign tertian parasites were found and two with clinical symptoms only were treated in this way. The results have been encouraging, as there have been no cases of recurrence up to date, and in no case has there been a further rigor after that succeeding the initial dose of quinine.

It was unfortunate for the sake of this experiment that no gametocytes were found in the blood of any of the patients who underwent the course.

The small number of cases treated and the shortness of time since the experiment was started, combined with the fact that all the cases were infected with the benign tertian parasite, precludes any very definite conclusion as to the efficacy of the method, but at the same time a further trial appears to be justified.

The incidence of malaria in Egypt is comparatively small when compared with that met with in stations in other parts of the world, and the type is almost entirely limited to one. On this account this forenote is written in the hope that officers who are in a better position to form a judgment might be sufficiently interested to carry on the experiment.

Further trial appears to be particularly necessary in those cases in which gametocytes are present in the blood; in these the question of giving larger doses by means of the hypodermic syringe might be considered.

If any officers should be inclined to carry on the experiment, I should be glad if they would publish their results in the Journal, and let me have a copy of the paper with any modifications in the treatment they may consider advisable.

This would enable comparison to be made with the results obtained by other methods.

The instructions for treatment as carried out at Moascar were as follows:—

(1) Note hour of attack.

(2) Two hours before probable time of next attack give quinine hydrochloride, fifteen grains.

(3) Give two further doses of quinine hydrochloride, fifteen grains, at four-hourly intervals.

(4) No further quinine to be taken until two hours before the next attack, when give quinine as before.

(5) If there is no rise in temperature during the second period and

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parasites are absent, carry out the same procedure, but with ten grains, for third and fourth periods.

(6) If there is no further rise in temperature and absence of parasites, give one dose of quinine hydrochloride, ten grains, about two hours before expected attack for five successive periods.

(7) In case of rise of temperature, or persistence of parasites during any period, the treatment followed at that period should be carried out for a further one.

(8) Iron and arsenic tonic to be given on the days when quinine is not administered.

(9) Diet to be light for first few days, but gradually increased if no ill-effects are shown.

(10) If fifteen grains of quinine cause ill-effects, reduce the dosage during first four periods by five grains.

(11) Calomel to be given on admission and on the night before the first single dose of quinine.

Sport.

SOME FISHING NOTES FROM THE U.P., INDIA.

By Major T. O. THOMPSON,
Royal Army Medical Corps.

(*Continued from p.* 230.)

Ranikhet.

This is taken as the centre, since it is the spot at which the angling members of the Corps are most likely to be stationed (with luck). Although not on a river itself, fishing can be obtained in three different directions by car journeys, varying from 14 to 42 miles. The various spots will be described in sequence with a short preliminary note of the possibilities near Naini Tal.

(1) There is a river which flows down from Naini past Kathgodam and at certain times, in the lower parts, looks delightful. Mahseer up to 10 pounds or so can be got between the camping ground of Ranibagh and Kathgodam, chiefly I understand on small spoon or live chilwa. It is very hot in this valley and the lower part of the stream is much netted.

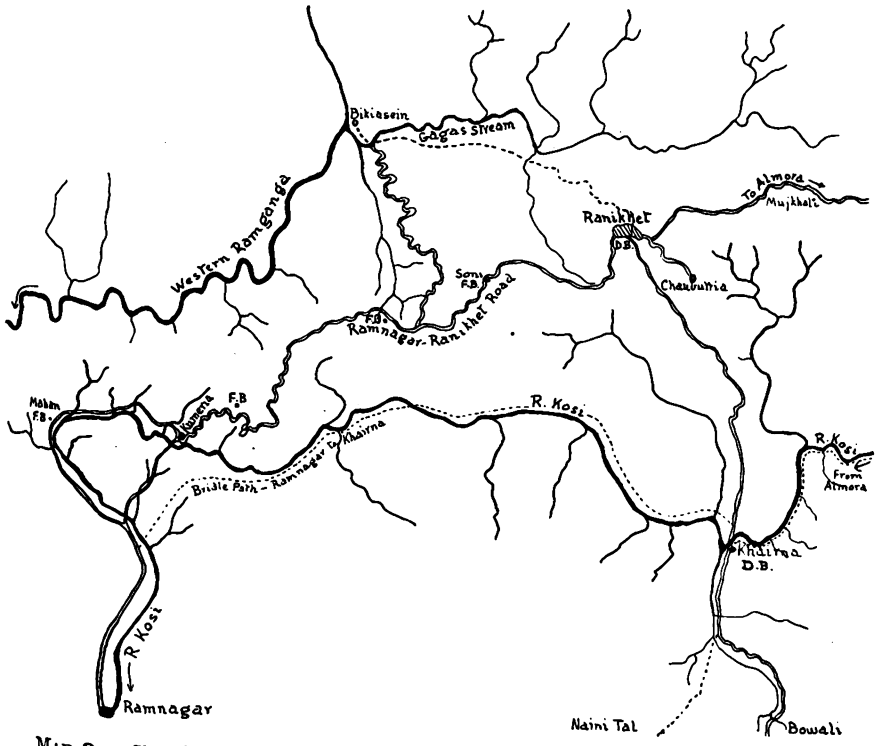
Naini Tal itself offers opportunities of fishing in a leisurely fashion with bait. The fish appear very shy, and I understand are usually caught very early or late in the day by the local fishermen. I have not fished there since boyhood, when I enjoyed some good fun with trout and small mahseer at the mouth of the stream at the western head of the lake. Much boating has now made a great difference and the books do not recommend fishing here as a sport.

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The Kumaon Lakes.

These have been extensively written up in many books, and I do not propose to describe them again. There are one or two points which may be of value, however.

There is now no need for the bridle path journeys from Kathgodam. The main road is now a double-way, very magnificent motor road, and one and a half hours in a good car will take you and all your kit for any period up to Bhowali. Porterage from there to Bhim Tal is only a matter of four miles. Or Bhowali (two hotels) may be made your centre for fishing excursions.



Map 3.—Sketch map of Lower and Middle Kosi. Note how the roads twist and turn along the ridges.

Sath Tal is said to give the best sport now. A 25-pound fish was caught last year on fly. But Mulwar Tal, although hot, is very good for fishing, scenery and shooting.

(2) Ranikhet to the Middle Kosi (15 miles).

This strip of the Kosi is reached from the main Kathgodam-Ranikhet road, which crosses the river by a big steel bridge in the valley nearly midway from Bhowali to Ranikhet.

Coming down from Ranikhet the road reaches the Kosi along the valley of the Ranikhet tributary (fourteen miles) and runs along the right

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bank of the Kosi to the bridge at Khairna, then away up the valley of the Garm Pani stream towards Bhowali. The bridle path from Khairna to Almora leaves the main road at the bridge and follows the left bank of the Kosi to within three miles of Almora. There is a good dak bungalow at Khairna, with a khansama who is the local expert on all the fishing here but who, also alas! removes many of the best fish.

Let us commence at the bottom of this section and work up. The majority of temporary anglers go directly to the bridge and flog the pools in the immediate neighbourhood.

Coming down from Ranikhet, stop just when the road comes to the Kosi bank. There is a small bunniah's shop. He will keep an eye on your car for the day for four annas. Usually coolies can be got here to carry the tiffin basket, etc., but not always. *Note.*—Do not overpay them; it spoils the market for others.

The bit below this can be fished best, perhaps, by following the river down, or it can be done by following the old Ramnagar bridle path, where it exists, near the river on the right bank; parts are broken clean away and the new path goes over the hill. On the old one a mile-stone is left on one section of three yards on the face of a cliff, 40 feet up in the air and many yards away from any semblance of a path, either above or below.

Just below the junction of the Ranikhet tributary is a good pool, best fished from the left bank. Eight hundred yards below this are towering cliffs where the river does a double twist out of sight from the road. Here are two magnificent deep pools, the lower of which holds some very nice fish and some good trout on the sandy tail end. A series of four good pools with excellent runs ends about ¾ mile lower in another cliff, where again a deep pool is formed. Above and below this are fords for those who stick to the old bridle path. Below this again the river makes a curve north round to west, and then opens into a very wide shingly area where there are no pools worth looking at for many miles. There are three good pools in the curve, but this lower portion is grossly and steadily netted all the year round.

However, this piece from the road to the open shingle part will give an excellent day's fun. It is hot down here and there is little shade, so do not fish in your thick Ranikhet suitings.

Note.—Much wading has to be done in this portion. The rocks are the most slippery I have met. I think a stout pair of ammunition boots with broad Alpine nails give the best hold, or a pair of nailed chaplis.

Ranikhet Tributary to Garm Pani Junction.

This part consists of rather open gravelly runs and pools which can always be relied on to give sport with a small fly spoon, and sometimes after a clearing flood gives excellent fishing. It is a good place for children, and my two sons have had many an excellent lesson in fishing on this strip. It is a little bit difficult to get down to from the road, and where the pools

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form depends on the varying movement of the river, but all the runs are fishable, and many are very suitable for children to practise in. A small fly spoon or a small yellow spider was found to be the best.

KHAIRNA.

This section is above and below the bridge. A car may be left by the shop or appears quite safe by the bridge. Immediately below the Garm Pani junction is a fine pool up against a cliff. It always has big fish, and many an exciting time have we all had in that pool. If the water is low enough we would all wade across to have lunch on a delightful shelf of rock, where an old bridle path ran which would always give shade, and from which one could look straight down into the depths and see the monsters of the pool. Many fish of 15 to 25 pounds have been taken from this pool.

It is an ideal pool to fish, and a whole day can be spent trying its inhabitants with every method of temptation. The anchored live chilwa is the method employed by the local professional. Below the bridge is a good pool but not easy to fish. A 36-pound fish was taken here last summer.

Above the bridge is a beautiful pool which, however, is assaulted by every would-be angler, practically day and night for many months. About 1¼ miles above the bridge is a large fine pool, much used for bathing parties, but a good fishing pool too. In the strip between are some six nice pools, but difficult to get at.

Above this again the river takes a wide sweep to the left and the path is much broken by shale. Except this section there is nothing worth looking at, but get straight on to the next section where the path meets the weeds again. *Note.*—In the middle of the shale is an excellent spring at the edge of the path ; this runs all the year round and can be regarded as quite safe. It is a godsend at the end of a day's fishing in June.

From the big bend is a series of four great, big, deep pools all of which hold big fish and are perfect for fishing. The topmost of these four comes out of a deep rocky cleft. It is extremely picturesque and is the best fishing pool.

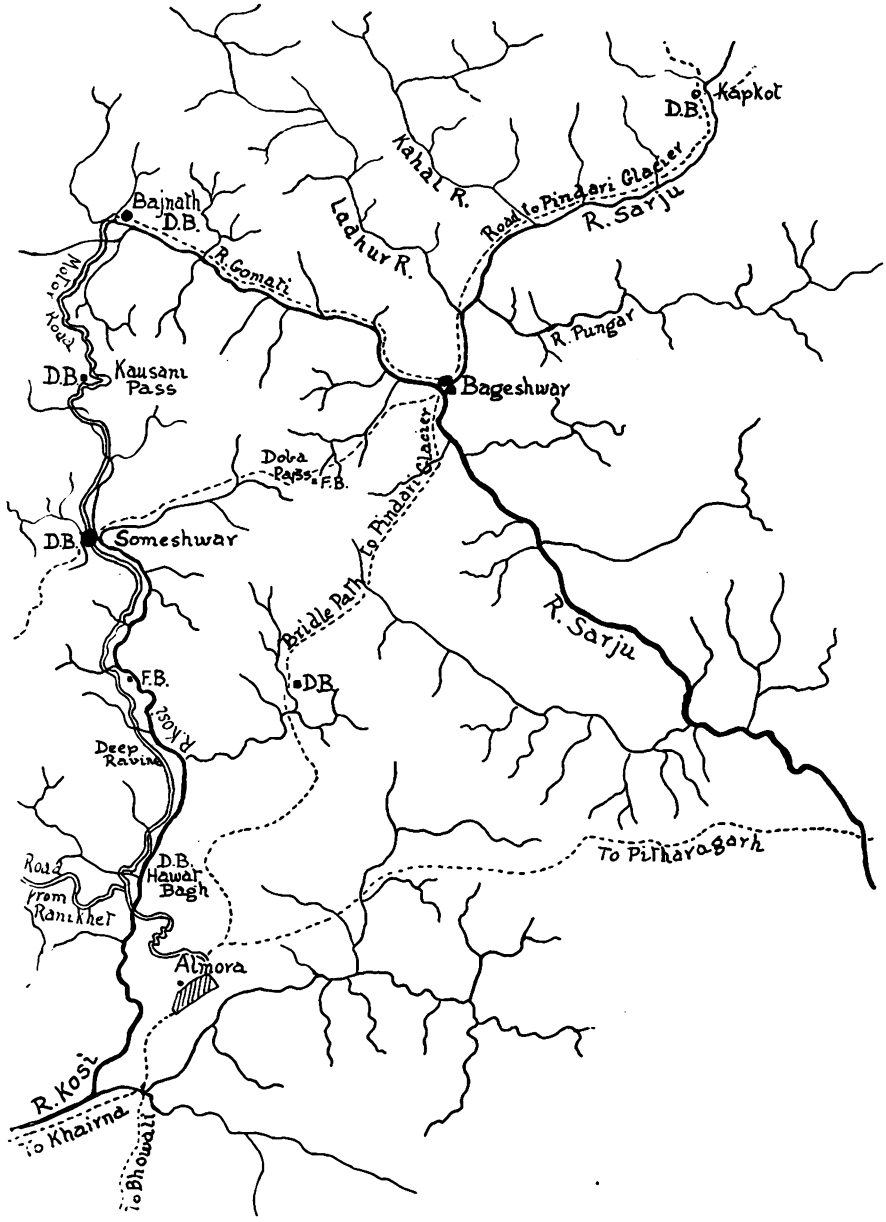
From this spot it is impossible to get on without climbing up on to the road, but after several hundreds of yards the road comes down near the water again, and from this point on there is a series of perfect pools which might almost have been artificially formed for over three miles, until the junction of a large tributary from the northern slopes of Chaubattia is reached. Walking and fishing from the bridge up to this point will give as hard a day's fishing as anyone could want.

(3) RANIKHET TO THE UPPER KOSI (26 miles). See Map 4.

Take the Almora road, until the road comes on to the right bank of the Kosi ; turn abruptly to the left along the Someshwar-Bajnath road. The

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road runs along the banks of the river for twenty miles or more. The scenery is beautiful and there are many miles of fishable water.



MAP 4.—Showing Upper Kosi and River Sarju.

Note.—Get 2 or 3 miles up from the turn, because Almora is garrisoned by Gurkhas who comb the pools from end to end, and think nothing of 6 to 9 miles as an afternoon's walk for some "fishing."

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The road requires some good driving, especially after dark when it is not supposed to be used. Remember that there is regular lorry traffic which may be met.

One of the best pieces is about 6 miles up from the turn, where the river comes out of 2 miles of a very deep and inaccessible ravine.

Another is where the road again dips down from above this ravine to the river which here flows amongst paddy fields. Above Someshwar the water gets very small, though I have seen a four pound fish under the stepping-stones of the Someshwar-Bageshwar bridle path.

(4) Ranikhet to the Lower Kosi (42 miles on the Ramnagar road). See Map 3.

This cannot be done in a day, there and back, or should not be, though I have done it and had several hours' fishing. Eighty-two miles may not sound much, but on that road an occasional spurt of 15 to 18 miles per hour, with an average pace of 12, only, is all that is reasonably safe.

Take the Ramnagar road until it dips right down to the Kosi right bank at Kumeria. The last five miles, from where there is a forest bungalow by the road, down to the river and along the river banks, can be extremely hair-raising, particularly after the monsoon. The road has, however, all been recently repaired. At Kumeria the old road used to cross the river by a wooden bridge and over the hill to Ramnagar. The bridge has been swept away, but the old road gives access to one good section of pools. There are four good pools in this section, with the bridge pool as the best. This series of pools comes below the long, open shingle portion of the river mentioned before. The bridge pool is a really ideal fishing pool, with a deep run, good rocks, shade, open gravel, and sandy patches. It holds some very big fish. We have had good fun with the family at these pools; also incidentally an extremely trying night with only a shot-gun, camped with the family in small tents on the old road in the river bed and a tiger roaring fifty yards up the khud side.

For the portion below this take the new road round the west bank of the river which goes to the famous Mahan bungalow and block. The fishing in this portion is in reserve forest and a day licence should be obtained, also permission from the holder of the block. The water is magnificent, with huge pools holding many fish, some of which are certainly large. It is distinctly warm down here in May or June, and after the monsoon highly malarious. If serious fishing is contemplated, application for the block should be made, but these two blocks are the best shooting blocks and almost always go to "big wigs," "officials" or their friends, although the forest folk will indignantly deny this if taxed with it. I know that in three years, although my name was submitted for it, I was not successful.

This portion of the river can also be reached from Ramnagar, which is

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connected by rail with Bareilly, but these notes are specially intended to show the way to get fishing from Ranikhet.

Method of Fishing for the Kosi.—I know of no river from which it is so hard to *catch* fish as the Kosi, considering the very large number of fish which one can see in the pools and runs. Time after time I have seen keen anglers, who evidently know their "job," arrive at Ranikhet full of enthusiasm at their sight of the Kosi on the way up, and who, after several fruitless days, have reluctantly realized the difficulties. I recollect one pool below Kumeria, where I stood high up on the cliff and watched the A.D.M.S. try every conceivable type of spoon, spinner, fly and lure in a pool which was literally carpeted with fish from one to twenty pounds in size. The results were that the fish merely separated, to allow the spinner to go past, then closed ranks again. So do not expect to find easy angling in the Kosi. The water is usually like gin in clearness. (*Note.*—Very often the Garm Pani stream will come down a milky white and give a "colour" to the section below it.) The fish are exceedingly wide-awake, as they are fished for all the year round with nets, lines, etc., by all the local villagers.

But even if the catching of fish is difficult, the scenery and the occupation are so fascinating that a day on the river, or in it, is well spent.

A picketed live chilwa is undoubtedly the bait to produce large fish, but the "sport" is commensurately small.

A bent formalin chilwa is the only other bait on which I have got decent-size fish. I have never got anything on a big spoon or artificial spinner.

The best fun in this river, however, is with a small fly spoon, not bigger than the nail of the fourth finger, made from thin aluminium and fished on a fine gut cast. This is used after the manner of a wet fly, with a draw and snick motion, through the runs, and is the method with which my youngsters have had best results.

We have frequently tried flies of all kinds. The yellow spider and Alexandra are sometimes successful, especially when muddy water has almost cleared, but the tiny spoon is the main standby. In the upper reaches a small black palmer, cochy bundhu, march brown and natural baits, such as "hopper grasses" (grasshoppers), have at times given excellent and exciting fishing to my family and others.

The Ramganga (Western). See Map 3.

This may be reached from Ranikhet by turning off the Ramnagar road twenty-three miles out down to the right, where a long valley leads to the junction at the Gagas river with the Ranganga (fifteen miles by road). Here is Bikia Sein, which is only twelve miles from Ranikhet by bridle path, though thirty-eight miles by road. The Ramganga here is a fine

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river which is so hopelessly netted and treated with wicker traps that it is not worth visiting this portion.

Some seven miles lower down it runs in a deep gorge and is in reserve forest. That is the portion which is written about with such enthusiasm in the various books.

The Sarju. See Map 4.

This is a bigger river than the Kosi and is well worth periodic trips, week-end or ten days, to anyone stationed in Ranikhet. The portion with which I am familiar is at Bageshwar which lies on the road to the Pindari glacier, two marches north of Almora. The fisherman from Ranikhet should not go to Almora, but motor up the Kosi to Someshwar, leaving the car at the forest resin dump, and walk the fourteen miles direct to Bageshwar.

There is a dak bungalow at Someshwar. The khansama can produce most requirements for any meal.

The easy way to do it is to motor in the afternoon to Someshwar, sending kit by motor lorry, stay the night there and walk leisurely to Bageshwar next day. Coolies are difficult to get at Someshwar, so write to the coolie agent at Bageshwar stating your requirements, arranging for them to be there overnight.

At Bageshwar, which lies at the junction of the Gomati with the Sarju, is a very good dak bungalow, with four sets of rooms, a khansama and a limited supply of ordinary eatables. Meat is a difficulty. Immediately in front of the bungalow is a most ideal pool with the lawn of the bungalow, edged with chestnut trees, reaching down to the bank.

The pool is "sacred"! and may not be fished.

Upper Bageshwar Section.

This consists of some three miles of river with excellent pools in a series the whole way up. Although there are certainly plenty of fish, I have never had much luck in this part.

Above this is the Bari ghat, where the river cuts a winding cleft a mile long through a high transverse ridge. The result is a magnificent gorge, with the road high up on the right bank. The banks are sheer rock faces, in some places only 15 feet apart, dropping straight into water probably 30 or 40 feet deep. There are tremendous undercurrents and it is not advisable to fall in. Attempting to fish is most fascinating, but how one would land a "big 'un" I do not quite see.

In the middle of the gorge on the left or east bank a large tributary, the Pungar, joins the Sarju; the lower portion of this will give the most strenuous day's fishing you could possibly want. There are some very large fish in the lower pools.

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The Gomati (Gumpti).

This stream flows down from the west, from Bajnath, and joins the Sarju immediately below the town.

Mahseer up to six pounds may be taken a long way up it, but I am told the fish run down out of it very soon after the monsoon.

The Lower Bageshwar Section.

This also consists of the three miles of river down to a huge gorge, where it is practically impossible to get at the water.

There are three very large pools in the first mile and half, viz., the junction pool, a long pool and run with the rocks and deep water on the left bank and a sandy bank on the right, a long curve eastward of broken water, then a very large pool with a fine run leading over a stony bar into deep water. Below this is a chain of four pools, up against the high rising left bank; these require to be fished from the right bank.

Then there is a very fine pool with long slate ledges or shelves forming the right bank. This pool can be fished from either side. It is full of fish and seldom fails, provided one keeps out of sight. The next pool has a high cliff on the left and must be fished from the right bank; the last or gorge pool can only be really fished from the left bank. It is a very fine pool and well worth trying. From whichever side fishing is done, about half the pools are accessible, but the better side to fish from is the right bank, along which the Almora road leads for a couple of miles.

The best pools are: (1) The junction pool; (2) the big pool where the road leaves the river; (3) the rocky shelf pool.

At the bungalow is a written notice specifying the exact demarcation of the sacred water. It definitely says, from a certain *cairn* of stones *down* to the junction of the Gomati and Sarju. This is because burning is carried out on the shallows opposite the temple. The junction pool is one of the best and, for obvious reasons, is full of big fish. Do not be intimidated by the priests or priestesses, and their virulent flow of abuse, from fishing in the junction pool below the junction of the waters. A 28-pound fish was my last fish here.

When leaving Bageshwar make certain of your coolies well beforehand, and also make certain that they have started over the Gomati bridge in front of you, otherwise they will hang about in the town for a couple of hours. If you do this it is quite possible to breakfast in Bageshwar, to walk across the pass to Someshwar (the road back up the pass is much steeper than the Someshwar side), to pick up your car and lorry at Someshwar and to reach Ranikhet in time for dinner (late). The lorry will probably not get through until next morning.

The best time for Bageshwar is May, and next best is September and the first half of October.

It is hoped that if these notes ever see the light of day in print in the

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Corps Journal they will be of some use in enabling others of the Corps to enjoy some of the excellent times which we have had, and that they will save the loss of valuable hours by allowing them to get directly to the best spots for their hobby.

Current Literature.

WILLIAMS, C. L. **A Rat and a Rat-Flea Survey of Ships at the Port of New York. A Study of Ships' Rats and Fleas as they are concerned in the Transfer of Bubonic Plague, with Particular Reference to Maritime Quarantine.** *Pub. Health Rep.* Wash. 1929, v. 44, 443-76, 1 chart. [10 refs.]

This is a highly interesting article based on a careful analysis of the results of the fumigation of ships in the Port of New York during a period of two years. An editorial note points out that conditions in New York are not comparable to those in other ports of the U.S.A., and that the inferences and deductions do not represent the views in general of the Public Health Service. The conclusions, however, appear sound and for the most part in accordance with impressions formed by port medical officers in Britain.

The classification of rat fleas shows that only *Xenopsylla cheopis* and *Ceratophyllus fasciatus* are present in sufficient numbers to be of any real significance. In ships plying between northern ports *C. fasciatus* is the predominant flea, but in ships trading to tropical and sub-tropical regions *X. cheopis* is almost exclusively found. This is probably an important factor in determining the freedom of northern ports from plague.

On all foreign-going ships the black rat (*Rattus rattus rattus* and *Rattus rattus alexandrinus*) predominates (99·65 per cent.). Rat harbourage amongst cargo is not a material factor in rat-infestation, but, roughly speaking, ships carrying rat-food cargoes have more than twice as many rats as those on which the cargo is non-attractive to rats. Sugar-carrying ships and oil tankers have few rats. An analysis of the results of periodical fumigations suggests that individual ships have a normal complement of rats which will be reached some 5 months after fumigation, and which in the absence of exceptional circumstances will not vary greatly even if there is no further fumigation for a period of 2 years.

It is suggested that a mass invasion of ships by rats is exceptional but that the great majority of rats are born on the ship they infest. Rat-proofing is thus of particular importance as it not only reduces the number of breeding places, but prevents escape during fumigation. The majority of vessels are relatively free of rats; consequently "it would appear illogical to spend the large sums required for fumigation measures on all ships in order to reach the few that are a menace. Obviously, if rat eradicative measures could be concentrated on the few infested vessels, time, money

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and labour would be conserved, and probably better results would be obtained on the infested vessels."

Rat-proofing on ships should be compulsory ; rat-infestation inspections should be made regularly and ships be fumigated on the basis of observed rat infestation, consideration being given to the danger of plague infection ; when fumigation is required it should be carried out with such a concentration of gas, such a period of exposure and as many times as is necessary completely to free the vessel of rats. CHARLES F. WHITE.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 1.

CHIARA, L. Expériences sur le résultat de l'action du gaz Clayton sur différentes denrées alimentaires. **[The Action of Clayton Gas on Various Food-Stuffs.]** *Bull. Office Internat. d'Hyg. Pub.* 1929, v. 21, 455-9.

These experiments were made to determine the action of Clayton gas (sulphur-dioxide) on food materials ordinarily found in ship's cargoes. Many kinds of food without any packing were exposed to the action of this gas under pressure at a concentration of 10 per cent. The gas pressure was maintained for 1 hour and then released, the foods remaining in contact with the gas for a further 24 hours. Typhoid and paratyphoid bacilli were killed under the same conditions which were far more severe than those ordinarily produced when ships are fumigated for rat destruction. Only a few foods were found to be altered by the treatment, and samples of these were packed by the usual methods and placed in a ship's hold which was fumigated in the normal manner. The gas reached a concentration of 4-5 per cent. in the depths of the hold where the foods were placed. Only a few products were affected. Apples softened but the taste was good ; potatoes (in sacks) were slightly bitter after cooking and tobacco had an acrid taste if smoked dry but this was prevented by preliminary washing. Foodstuffs containing moisture must form some sulphurous acid from the anhydride and should be removed before fumigation. There was no effect on dyed materials if dry and of good quality but if moist decolorization occurred. Usually the ship's cargo is cleared before fumigation, but where this is not possible the more vulnerable materials should be removed. The author strongly favours the use of Clayton gas considering it much less harmful than other toxic gases such as hydrocyanic acid which are really dangerous to foods. H. N. H. GREEN.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 1.

MELLANBY, E., & GREEN, H. N. **Vitamin A as an Anti-Infective Agent. Its use in the Treatment of Puerperal Septicæmia.** *Brit. M. J.* 1929, June 1, 984-6. [3 refs.] [Pharmacol. Dept., Univ. Sheffield.]

On the basis of animal experiments which indicated that vitamin A is an anti-infective agent, and which have been recorded in a previous paper

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(this *Bulletin*, 1929, v. 4, 97), the authors have treated five cases of puerperal septicæmia with preparations rich in this substance. From each of the five cases hæmolytic streptococci were isolated by blood culture. All five cases recovered. Two preparations were employed. One, X, was about 10 times, the other, Y, was about 150 times as rich in vitamin A as cod-liver oil. The preparations were given by the mouth (X hypodermically to one patient), X in doses of 2 drachms twice daily (about 15 cc. in all), and Y in doses of 2 minims hourly in a teaspoonful of orange juice for 12 doses daily (about 1·5 cc. in all). In assessing the significance of the results it is noted that, in the same hospital, 22 of 24 cases of puerperal septicæmia, due to hæmolytic streptococci, died during the two years previous to that in which this treatment was commenced. [A comparison of this kind is, of course, entirely unsatisfactory as statistical evidence, and the number of treated cases is clearly too few to establish more than a *prima facie* case for further investigation. Equally clearly the few results recorded are of great interest and importance.]

W. W. C. Topley.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 1.

Pagniez, P. L'emploi en clinique de la vitamine A comme agent anti-infectieux. **[Vitamin A as an Anti-Infective Agent.]** *Presse Méd.* 1929, v. 37, 1123-4. [2 refs.]

This article deals with the work of Mellanby and Green on vitamin A as an anti-infective agent in rats [see this *Bulletin*, 1929, v. 4, 97] and with the later publication of these workers on the use of vitamin A as an anti-infective agent in the treatment of puerperal septicæmia which is abstracted above. Five cases of puerperal septicæmia with hæmolytic streptococci in the blood were treated with preparations rich in vitamin A. The blood-cultures became negative in all cases, usually about 14 days after the commencement of vitamin A treatment. All the patients made complete recoveries. At the same hospital during the previous two years, there had only been 2 recoveries out of 24 cases, giving a mortality of 92 per cent. The vitamin A preparations were given by mouth at frequent intervals. One preparation employed was about 10 times richer in vitamin A than cod-liver oil, the other being 150 times richer than cod-liver oil. Although, as stated by Mellanby and Green, the number of cases is too small to allow the deduction that this form of treatment is specific for septicæmia, the results nevertheless warrant the belief that vitamin A has the property of raising the resistance of the body to bacterial infection. This work suggests that vitamin A may be of great importance as a prophylactic and emphasizes the importance of ensuring adequate amounts of vitamin A in the diet especially during pregnancy.

Douglas C. Harrison.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 1.

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COLLISON, Dorothy L., HUME, Eleanor M., SMEDLEY-MACLEAN, Ida, & SMITH, Hannah H. **The Nature of the Vitamin A Constituent of Green Leaves.** *Biochem. J.* 1929, v. 23, 634-47. [37 refs.] [Lister Inst., London.]

The unsaponifiable matter from cabbage was prepared by extracting the dried leaves with light petroleum, saponifying the fats in the residue by allowing to stand over night with alcoholic sodium ethoxide and extracting with ether. The green leaves yielded 3 to 4 times as much unsaponifiable matter as an equal weight of white leaves, and the substance obtained from the green leaves was much more unsaturated as indicated by the higher iodine value. The vitamin A potency of the product from the green leaves was at least 10 times as great as that from the white leaves. After extraction of the unsaponifiable fraction from the green leaves with alcohol, an oily residue remained which, when dissolved in warm light petroleum deposited crystals of carotin. After recrystallization, these melted at 178° C. Carotin crystals prepared from spinach and carrots melted at 163-164° C. and 164-9° C. respectively. All specimens gave a blue colour with antimony trichloride and were capable of restoring growth of rats when added in small quantities to a vitamin A-deficient diet. The minimum dose of the specimen from cabbage was 0·002-0·0005 mgm. (fed in cotton-seed oil). This latter preparation was the most potent in vitamin A activity and since it had the highest melting point was probably the most pure specimen of carotin. The authors discuss the possibility that more than one substance may be able to function as vitamin A.

DOUGLAS C. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 1.

CORNELIUS, J. T. **An Investigation of the Serological Relationships of Twenty-six Strains of *Pasteurella*.** *J. Path. & Bact.* 1929, v. 32, 355-64. [15 refs.] [Lister Inst., London.]

The inter-relation of the strains which fall within the genus *Pasteurella* has long formed one of the many puzzles of systematic bacteriology. It has been the convention to label strains according to the animal host from which they have been derived; and in this way we have collected a numerous family christened *Pasteurella aviseptica, Pasteurella oviseptica, Pasteurella suiseptica, Pasteurella lepiseptica, Pasteurella muriseptica,* and so on. But we have all recognized that this is a classification *pour faire rire*—one of those eccentricities which, at present, introduce a romantic element into bacterial nomenclature.

There have been many attempts to apply the method of antigenic analysis to the classification of this group; but the results have not yet brought order out of chaos, though they have shown quite clearly that our present terminology bears no relation to reality.

The author, in a careful study of 26 strains of *Pasteurella* bearing the

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conventional labels, has obtained results which permit a grouping on the basis of agglutinin absorption. Like many previous workers he has experienced considerable difficulties, owing to the varying agglutinability of different suspensions of a single bacterial strain. The technique finally adopted was as follows. Suspensions of living bacteria were employed both for absorption and for the final agglutination test. For absorption, saline suspensions from agar cultures were employed, since these proved relatively constant in their absorptive capacity, though they varied too widely in agglutinability to form satisfactory test suspensions for the titration of the unabsorbed agglutinins. The saline suspensions were centrifuged, and 0·1-0·15 cc. of the tightly-packed bacterial deposit was made up to 0·5 cc. with saline, and added to 0·5 cc. of the agglutinating serum under test, previously diluted to about one-thirty-second to one-sixty-fourth of its full titre. Absorption was allowed to proceed for 1 hour at 37° C. The mixture was then centrifuged, and the supernatant fluid was tested against undiluted living broth cultures of the strains under examination. Agglutination was allowed to proceed for 18-24 hours at 37° C. In some cases living saline suspensions were employed in place of broth cultures. The author stresses the necessity for putting up full controls with each series of tests. It may be noted that some difficulty was encountered in preparing satisfactory agglutinating sera. For the inoculation of rabbits, saline suspensions of agar cultures were employed, killed by heating at 60° C. for 1 hour. With some strains, of low antigenic potency, doses as large as the combined growths from 8 agar slopes had to be repeated at 5-day intervals for several weeks before an adequate titre was obtained. The final titre of the sera employed, tested against an agglutinable suspension of the homologous strain, varied between 1/800 and 1/12,800.

Using this technique, the author was able to relegate 17 of his 26 strains to one of four serological sub-groups.

Group I contained one strain labelled *boviseptica*, one strain labelled *caviseptica*, two strains labelled *aviseptica*, and three strains labelled *lepiseptica*.

Group II contained one *aviseptica*, one *lepiseptica*, and three *muriseptica* strains; but the history of the last three strains suggests a common origin.

Group III contained three *suiseptica* strains.

Group IV contained one *suiseptica* and one *lepiseptica* strain.

The remaining 9 strains showed no absorptive affinity to these groups, and, with a few minor exceptions, showed no antigenic relationship to each other.

W. W. C. Topley.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 1.

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Reviews.

A Medico's Luck in the War. By Colonel D. Rorie, D.S.O., T.D., Aberdeen. Milne and Hutchison. 1929. Price 8s. 6d.

This is a charming book. Colonel Rorie commanded the 1/2nd Highland Field Ambulance of the 51st (Highland) Division and held the appointment of A.D.M.S. of the Division in 1918. He describes in a simple and most amusing way the story of his unit and presents an excellent picture of the duties, arduous and varied, that fell to the lot of the medical services of a Division in the late war. As an instructional book it will be of practical value to officers wishing to study the employment of field medical units in static warfare.

As anyone who knows David Rorie will understand, he cannot get far down a page without making a joke, and his breezy, human tale of a Territorial field ambulance in action and at rest, if it frequently touches upon the tragic, contains a fund of amusing anecdotes and episodes. However rough the times might be, however active Jerry became with his "ironmongery," and other expressions of war-time rudeness, the author's acute sense of humour remained unblunted.

He has a good hit at an old-fashioned type of senior officer, who may have existed in the flesh but became very rare as the war went on. Our consolation is that to-day the type is extinct. And if in existence in the first phase of the war, well it provided material for humorists like Rorie, material upon which they could exercise a pretty style of wit.

But Colonel Rorie saw more than the funny side of the war. All through his pages one finds him a writer with a delightful mind who can appreciate so much that others have not chronicled. He can see the beauty of the countryside through which his unit is marching; he has a historical sense which finds expression in discussing with the French people the old Franco-Scottish Alliance, or Mary Stuart; in the village where he is billeted he is sure to find something of archæological or historical interest, and he can appreciate a beautiful church and a venerable chateau. Through the war went David Rorie with his eyes open and his imagination in full activity, which is more than many of us did.

To the "Furrst-Second," the "Furrst-Thurrd," and the "Second-Furrst," the three Highland Field Ambulances that formed part of a glorious fighting Division, I take off my hat to my old friends and say, they are fortunate to have their brave doings put into such a soldierly story by Colonel Rorie's gifted pen.

M. B. H. R.

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A Textbook of the Practice of Medicine by various Authors. Edited by Frederick W. Price, M.D., F.R.S. Third Edition. 1929. London: Oxford Medical Press. Pp. xxxviii + 1871. Figs. 115. Price 30s. net.

In producing the new edition of this popular textbook, Dr. Price and his contributors have made such a thorough revision and added so much new material as to ensure its retaining the high position it holds among students and practitioners of medicine.

One can hardly realize how many new ideas in medical practice have been formed during recent years, until one compares such a volume as this with its predecessor which appeared only three years ago. We have counted 35 new articles, 30 insertions of new matter and 20 articles that have been wholly or largely rewritten. The subjects of these new features embrace every branch of medicine.

To praise the work is superfluous; there are few who do not know and study it. They can feel secure that with this new edition they are able to avail themselves of the most up-to-date knowledge of the practice of medicine. As regards the actual get-up of the book it remains the same compact, easily handled and well printed volume as before.

The Internal Secretions of the Ovary. By A. S. Parkes, M.A., Ph.D., D.Sc. London: Longmans, Green and Co. 1929. Pp. xv + 242. Figs. 69. Price 21s. net.

Dr. Parkes has collected in this volume the results of the researches carried out during the past few years by many physiologists on the internal secretions of the ovary.

That this research has been active is evidenced by the number of the bibliographical references adduced, 661 in all; that it has been fruitful can be gauged by a consideration of the remarkable widening of our knowledge of the effects of the secretions of œstrin, lutein and pituitrin on the female generative system.

From the physiological experiment to the application by the physician will be a short step, and for this reason the book should be studied by a much wider circle than that of the physiologist.

The more general sections of the work such as the morphology of the female reproductive organs are merely introductive; the œstrous cycle is dealt with fairly fully, while the chapters on the endocrine control of these organs are complete.

It is a very well written and well illustrated volume.

Marlborough and his Campaigns, 1702-09. By A. Kearsey, D.S.O., O.B.E., *p.s.c.*, late Lieutenant-Colonel, General Staff, Aldershot, 1929. Gale and Polden, Ltd. Price 3s. net.

The author has written this book as an aid to those who wish to study the personality and military science which this most famous British

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Commander possessed. His battles are described in conjunction with Field Service Regulations. The arrangement is a diary of events followed by an analysis of strategical and tactical moves and decisions with a reference to each conforming article of doctrine in the regulations on which the army is trained at the present day.

One may wonder whether Marlborough's methods are of much value now. Is he out of date? A great general and his methods of winning battles must always command the interest of military students. Weapons may alter but the principles of war science seem to remain remarkably constant. Successful campaigns seem to have been due to two factors, a commander who stuck to these principles and a defeated opponent who ignored them. One gets the impression, right through military history, that the crushing defeat was the result of ignorance or stupidity on the one hand, and military knowledge on the other. It takes two to make a quarrel and it takes at least two to make a military disaster. Or shall I say that *the crushing blow which annihilated an army in the field has too often been nothing more or less than a self-inflicted wound*? Secretaries of State and First Lords might make a note of this, if the Kellog Pact and the League of Nations permit.

At any rate Marlborough was an accurate military scientist whom we are apt to forget. It is refreshing to find his mastership of war recalled at the present day. And to any who are interested in history this book gives, concisely and intelligently, an excellent account of Marlborough's chief campaigns and battles, with a commentary on his methods and his foresight. M. B. H. R.

KRANKHEITEN UND HYGIENE DER WARMEN LÄNDER. By Professor Dr. Reinhold Ruge, Professor Dr. Peter Mühlens u. Professor Dr. Marr zur Verth. Third Edition. Leipzig: Verlag Georg Thieme. 1930. Pp. 494. 8 plates (6 in colour) and 489 photos, diagrams and drawings. Price 42 marks.

The third edition of this German work on "Diseases and Hygiene of Warm Countries," has recently made its appearance. The book is very well printed on good paper, and contains a large number of excellently reproduced photographs, diagrams and drawings. For anybody conversant with the German language it is easily readable, and the descriptions of most of the diseases, in many cases from the personal observation of the authors, are very lucid. The latest methods of treatment and newly discovered preparations (according to the authors largely German) are all dealt with. Amongst these great claims are made for plasmochin in the treatment of malaria, either alone or in combination with quinine, for Bayer 205 in the treatment of sleeping sickness, and for neostibosan, an antimony preparation only one hundredth part as toxic as antimony tartrate, in the treatment of kala azar. Neostibosan possesses the advantage that it can be given intra-muscularly, an important consideration when one is dealing with

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children with small veins, and it is claimed for it that it can cure kala-azar within eight days by a series of graduated daily injections, though admittedly four to seven per cent of the patients do not respond to it.

If one may be permitted to make any criticisms, the following points deserve mention. In some of the diseases the description of the signs and symptoms is hardly sufficiently exhaustive, though this is mainly the case with those diseases which cannot be properly called tropical diseases, but are of a universal distribution, and included for the sake of completeness or because they are more frequent in hot climates than in temperate ones. I refer amongst others to Weil's disease, the signs and symptoms of which are described in fifteen lines. Even more noticeable is this in the case of smallpox, in the differential diagnosis of which chickenpox is not even mentioned. On the other hand a large amount of space is devoted to certain bacteriological methods and the preparation of media, the recipes for some of which are reminiscent of a prescription of the Middle Ages.

In the English textbooks one is so used to having the diagnosis and prognosis of a certain disease dealt with before its treatment, that the opposite arrangement, which prevails in this book, is slightly disconcerting to the reader.

Comparatively little mention is made of certain experiments dealing with the developmental history of some of the viruses, e.g., the experiments of Leishman with regard to the spirochætes of relapsing fever are practically not mentioned at all. A short historical survey of some of the diseases would also have been a welcome addition. On the other hand a good deal of space is devoted to a large number of local diseases and skin diseases of the tropics, but the matter appears so complicated that the reading of the articles dealing with them leaves one with a feeling of bewilderment. A good differential diagnosis in connection with these, as far as that is possible in our present state of knowledge, would have been very useful.

The thoroughness with which some points are dealt with is exemplified in the suggestion that when using tinned food in the tropics, it is advisable to select tins of a size holding sufficient for one meal only, as the contents of the once opened tin perish rapidly.

In conclusion, the book is well worth reading and contains numerous interesting observations. E. O. A. S.

ANÆSTHESIA AND ANÆSTHETICS. By F. S. Rood, M.B., B.S., and H. N. Webber, M.A., B.Chir. London: Cassell and Company, Ltd. 1930. Pp. xi + 292 with 4 half-tone plates and 56 illustrations in the text. 14s. net.

This is a handy volume for the student of anæsthetics. The paper and printing are excellent, and the style fluent and easy to read. The chapter on "Choice of Anæsthetic and use of Preliminary Medication," is a valuable contribution to the subject.

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"Cases of Special Difficulty" are considered in a full and clear manner.

The section on shock details the necessary factors concisely, and will be found helpful.

Theories and details of the pathology of anæsthesia are not dealt with, indeed had they been incorporated in a book of this size it would have necessitated the exclusion of much valuable advice.

The administration of rectal ether is not described.

The index might with advantage have more cross references. Fits and convulsions are not to be found in the index, though there are references to them under "asphyxial tremors." Acidosis and acetonuria are not mentioned in the index or in the book itself, though there is a section on delayed chloroform poisoning.

The illustrations are on the whole good, though that on p. 177 showing the administration of oro-nasal gas portrays the patient with a tightly tied collar and tie, while under anæsthesia.

The authors have skilfully placed before the student much valuable advice and warned him of pitfalls that may beset the unwary.

The book can be thoroughly recommended. L. M. R.

"THE JUNIOR": A HISTORY OF THE JUNIOR UNITED SERVICE CLUB. By R. H. Firth.

This is a most interesting and readable account of the origin and vicissitudes of the Junior United Service Club, which, being the first General Service Club to take in officers of the Medical Services as members, is of peculiar interest to us.

The book, besides being an accurate historical narrative contains enough of detail and incident to shed light upon the changing ideas and customs of the passing years, covering as it does, a period of over a century.

The Club was founded with the object of supplying accommodation for junior officers of the Army and Navy, and officers of auxiliary Services, whose rank and classification rendered them ineligible for membership of the United Service Club (Senior) and, in the words of the officer who proposed its formation, "to have the effect of preventing young and inexperienced officers from resorting to those haunts of excess and dissipation of which so many have been the deluded victims."

The project was warmly encouraged by the senior officers of the Army and Navy, the Duke of Wellington and Vice-Admiral Sir G. Cockburn being among its patrons.

A committee of thirty-eight officers was nominated by the patrons, and in 1827 the first committee meeting was held at the British Coffee House in Cockspur Street, to take steps for the establishment of the Club.

The Club occupied temporary quarters at first, and finally bought the Club House of the United Service Club, which was later pulled down, and replaced by the present building erected by the Junior United Service Club in 1857.

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Its membership was at first limited to 1,500, comprising officers of the Royal Navy, Regular Army and Garrisons, Royal Marines, Fencibles, Regular Militia and Volunteer Corps, Officers commissioned by His Majesty, and the Naval and Military Services of the Hon. East India Company. The expression "officers commissioned by His Majesty" was amplified and included secretaries of Admirals, chaplains, physicians, surgeons, assistant surgeons, masters and pursers of armed Indiamen, prize agents, veterinary surgeons, surgeons and storekeepers of the Ordnance. As the author points out, it was a protest against Service exclusiveness, and the Junior has always been the most liberal of the Service Clubs.

From time to time, indeed, attempts have been made by cliques to exclude by blackballing, groups or classes of candidates for election to membership who were eligible under the rules, but the Committee has always rectified these nefarious endeavours.

The Junior deserves well of our Service, and the Committee almost constantly has some of our officers among its members, indeed on five occasions the chairman has been a medical officer.

As the author points out, customs have changed vastly since 1827, and even in the experience of present members there has been such a relaxation of rules as would not have been thinkable even twenty-five years ago.

Smoking, which at the time of the Club's formation was absolutely forbidden on the Club premises is now indulged in everywhere. Sumptuary laws are in abeyance—the invasion of the Club by ladies is now fully recognized, although they are kept to certain apartments. The whole face of Club life has changed, and in these days of cutting down armaments and officers, of early marriages, and impoverishment of families, it seems quite unlikely that all the Service Clubs can continue to exist, at any rate on their present scale, and their future is a matter of great anxiety.

From the historical point of view the book is most valuable, and it is, moreover, very pleasant reading.

H. E. R. J.

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Correspondence.

APPRECIATIONS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR.—Major Reynolds in the February number of the Journal has asked one or two very pertinent questions which form, to my mind, the best contribution to the vexed question of "appreciations" that has so far appeared. In order to save officers much troublesome thought in trying to answer these questions, and to help in allaying the not unnatural irritation that may be caused by the apparent indifference of the "powers that be" to this subject, I would like to say that the points raised by Major Reynolds have been under careful consideration in the War Office for the past five and a half years, and that they will be discussed as fully as possible, in the light of the experience gained in the several campaigns of the Great War, in the final (statistical) volume of the Medical History of the War. This volume is in the hands of Major T. J. Mitchell and should be published towards the end of this year.

Until then the numbers of beds in medical units should be taken as laid down in R.A.M.C. Training. Any modifications from that scale considered necessary for any particular campaign form the essence of the "appreciation."

War Office,
Whitehall,
London, S.W. 1.

I am, etc.
H. B. FAWCUS,
Lieut.-General.

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Notice.

CENTENARY OF THE INDEPENDENCE OF BELGIUM—LIEGE INTERNATIONAL EXHIBITION, 1930.

Fifth International Congress on Physiotherapy, September 14 to 18, 1930.

The Fifth International Congress on Physiotherapy will take place at Liege from September 14 to 18 next. Twenty-five countries have already appointed National Committees, and the particular subjects of discussion will be "The Rôle of Physiotherapy in the Treatment of Rheumatic Disorders," "Physiotherapeutic Treatment of the Disorders of the Central Nervous System," and "The University Teaching of Physiotherapy." There will be Sections dealing with Kinestherapy and Physical Education, Radiology, Electrology and Thermotherapy, Hydrology, and Actinology.

The Second Annual Meeting of the International League against Rheumatism will be held in Liege from September 18 to 20, and members of the Fifth International Congress on Physiotherapy will be allowed to take part in all the meetings of the League against Rheumatism.

As regards travelling concessions, the Belgian Government has agreed to allow a reduction of 35 per cent on tickets of those attending the Congress, and this also applies to the journey from Dover to Ostend. The French Government has also agreed to a reduction of 50 per cent on all their tickets.

Those who are desirous of attending the Congress should communicate with the Honorary Secretary of the British Section, W. Kerr Russell.

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EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

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Communications in regard to editorial business should be addressed "The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, War Office, Whitehall, London, S.W."

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The Annual Subscription for the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is £1, payable in advance. Single copies, 2s. per copy.

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J. N. Comper, pinxit

THE MEMORIAL WINDOW IN WESTMINSTER ABBEY

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VOL. LIV. MAY, 1930. No. 5.

Authors are alone responsible for the statements made and the opinions expressed in their papers.

Journal
of the
Royal Army Medical Corps.

ROYAL ARMY MEDICAL CORPS WAR MEMORIAL.

EARLY in 1919 a General Committee composed of some forty representatives of the Army Medical Services and of all ranks and all branches of the Corps, held its first meeting, with Lieutenant-General Sir Alfred Keogh in the chair. It was decided that subscriptions be invited from the Corps and from the public with the object of erecting a monument, to include a list of names of the fallen, in Central London; that replicas, if possible, be provided for Edinburgh and Dublin; that a fund be formed from which grants in aid should be made to necessitous families of the deceased, subscriptions to be earmarked for that object; that the founding of Scholarships or Memorial Prizes be considered.

Field-Marshal His Royal Highness the Duke of Connaught, K.G., Colonel-in-Chief, kindly consented to act as Honorary Chairman of the Committee.

Subscriptions came in slowly, the urgent business of reconstruction occupied the War Office, and by the end of 1920 not much progress had been made with the Memorial; but about £20,000 had been collected, of which some £1,600 were earmarked for the Benevolent Fund. The bulk of this latter sum had been contributed by Portsmouth and Netley, and after consultation with these two collecting committees, this money was handed over in equal shares to the R.A.M.C. Regular and Auxiliary Funds respectively.

Two retired officers were, in December, 1920, appointed Acting Honorary Secretaries, and requested to explore the ground and to make suggestions.

In 1920 to 1921 the erection of a structural monument in Central London presented special difficulties. The fund available gave no promise of procuring anything of outstanding merit and importance at the prices ruling at that date.

An exhibition at Burlington House of models and designs showed no

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great wealth of inspiration. The State authorities would grant no site in a central position with the exception of one-fourth part of a gateway in St. James's Park to be shared with three other branches of the Service, a scheme which was refused by all concerned and which never materialized. It seemed likely that we should be driven to adopt a site either at Millbank or at Aldershot, both of them places little appropriate for the memorial of men drawn in the main from civil life and from all parts of the country.

One of the acting Hon. Secretaries, Colonel Tyrrell, then conceived the idea of embodying our Memorial in the edifice of the Central National Monument, Westminster Abbey. At that time, thanks to neglect during the war, the Abbey authorities were gravely concerned for the stability of the building and were crying out for financial assistance.

This suggestion met with the warm approval of the Director-General, Sir John Goodwin, and the following proposals finally took shape: (1) A substantial grant to the Abbey Restoration Fund; (2) the erection of a Commemorative Mural Tablet in the Abbey with replicas in Edinburgh and Dublin; (3) the production of a Golden Book to be preserved in the Abbey precincts.

His Royal Highness, the Colonel-in-Chief, expressed himself as most sympathetic to, and appreciative of, the scheme, and desired all ranks to be consulted upon it.

On February 25, 1921, the General Committee, augmented for the occasion by several fresh representatives of other ranks, met to discuss the new proposals.

The Chairman, Sir Alfred Keogh, introducing the subject in a highly appreciative speech, said: "I cannot imagine anything more beautiful than that our Corps should be memorialized in the great Abbey, and that there should be this Golden Book which will be kept for many hundreds of years, setting forth the services and the sacrifices of the Medical Corps."

The Vice-Chairman, Sir John Goodwin, outlined the scheme and proposed a donation of £10,000, explaining that the architectural problems were such that no special portion of the Abbey could be allocated to our Memorial.

Sir Norman Moore, President of the Royal College of Physicians, in a speech warmly seconding the motion, said: "A more beautiful, a more appropriate, better chosen monument and Memorial could not be imagined than the one you have described. . . . You will feel that your comrades, your relatives, are receiving the highest honour which the Nation can give; an honour which they so well deserve; and, speaking as the representative of the College, I am sure that we should regard with the utmost gratification the erection of a monument so full of taste."

Sir Norman, probably the greatest authority on the history of medicine, added that in this country books had proved to be the most enduring of monuments, thanks to their protection from the weather and their easy salvage from fire.

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Sir Anthony Bowlby, President of the Royal College of Surgeons, and other representatives of the medical profession, sent their strong support by proxy.

Sir Arthur Sloggett said: "I do not think you could possibly have selected a more charming idea, or an idea more in keeping with the fine work and traditions of our Corps."

Sir Launcelotte Gubbins said: "This is an admirable thing, well conceived." And after speeches in support by Sir William Macpherson and junior officers, the non-commissioned officers were invited to express their views.

Serjeant Hewitt said: "I should feel it a great honour to be represented in the Abbey, a very great honour indeed to the Corps."

Staff-Serjeant Walton said: "I think you may take it that the non-commissioned officers and men throughout the Corps will be highly honoured and will appreciate the suggestion very much indeed."

Quartermaster Serjeant Boyes, T.A., speaking for the Territorial Army, said: "People from all parts of the country come up to London and all recognize the Abbey as the Valhalla of the Nation; therefore, I think it is an ideal suggestion."

No amendments being offered, the proposals were put from the chair and carried unanimously; so the original scheme of 1919 was replaced by that of 1921.

A small Executive Committee under the Chairmanship of the Director-General and two Honorary Secretaries were then elected and entrusted with the completion of the Memorial.

For the production of the Golden Book, the Executive Committee selected Mr. Graily Hewitt, an artist who had already created the best modern examples of illuminated script. He has produced for us a book which is considered to be the finest piece of work of this kind in existence. It lies in the Chapter House of the Abbey, and can be examined any week day, under the supervision of the custodian, who has permission to sell for 1s. 6d. the printed "Roll of Honour" which contains some reproductions from the Golden Book.

It may be of interest to anyone who, in the future, undertakes the production of such a book, to know that, thanks to misspelling, reduplications, omissions, etc., in the official lists, the task is an arduous one. After much work in two offices and that of a professional abstractor, a correct list was not obtained until a club of young men, under the guidance of Mr. William Pretty, had given up nearly a month of evenings to this voluntary labour of love.

The production of the Mural Tablet was entrusted to Mr. F. T. Wilcoxson, Professor of Lettering at the South Kensington Museum School of Sculpture.

The replica in St. Patrick's, at Dublin, is from his chisel, while the tablet in St. Giles', Edinburgh, is the work of Sir Robert Lorimer.

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ROLL OF OFFICERS
WARRANT OFFICERS
NONCOMMISSIONED
OFFICERS AND MEN
OF THE ROYAL ARMY
MEDICAL CORPS
WHO GAVE THEIR
LIVES FOR THEIR
COUNTRY IN THE
YEARS 1914–1919

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On the North Wall of the Nave of Westminster Abbey, close to the tomb of the Unknown Warrior, is set a memorial tablet with the inscription:

MCMXIV–MCMXIX

ROYAL ARMY MEDICAL CORPS

In memory of 743 Officers and 6130 Warrant Officers, Non-Commissioned Officers and Men who fell in the Great War, and whose names are enrolled in a Golden Book placed in the Chapter House.

"They loved not their lives unto death."

Here at noon on Thursday, 13th July, 1922, after prayer and the singing of the Contakion for the faithful departed the tablet was uncovered by His Royal Highness the Duke of Connaught, Colonel in Chief of the Corps, and dedicated by the Right Reverend Bishop Ryle, Dean of Westminster, "To the Glory of God and in the Name of Jesus Christ in proud and thankful memory of those officers and men of the Royal Army Medical Corps who fell in the Great War in the Name of the Father and of the Son and of the Holy Ghost."

The Dean also expressed his grateful and that of the Chapter of Westminster Abbey "for the great and magnificent donation" by the Royal Army Medical Corps to the Abbey Restoration Fund, and made offering of the gift with a special Collect. There followed the singing of Bishop Walsham How's noble hymn "For all the Saints who from their labours rest," and at close of service the sounding of the Last Post and Réveillé by a party of the Buglers of the Corps.

A Very great company of serving and retired members of the Army Medical Service and the Royal Army Medical Corps and of relatives and friends of the fallen attended; among them Her Royal Highness Princess Christian, Field Marshal Lord Methuen, Lieut.-Generals Sir Alfred Keogh, Sir Arthur Sloggett and Sir John Goodwin; Representatives of the Royal Navy and the Civil Ministries; of the Order of St. John of Jerusalem; of the British Red Cross Society; of the General Medical Council; of the Universities; of the Royal Colleges of Physicians and Surgeons; of the Society of Apothecaries; of the British Medical Association, of the Fellowship of Medicine; of the Medical Society of London; of the Royal Society of Medicine.

Of the 743 fallen Officers 429 were killed in action or died of wounds & 41 were drowned: of other ranks 3140 were killed in action or died of wounds and 489 were drowned.

With the numerous and great armies that were raised the Corps, represented by officers and men of the Regular Army, Special Reserve or Territorial Force, or by officers holding temporary commissions, served on eight different fronts; and won honours that include the Orders of the Bath, St. Michael and St. George and the British Empire, and the following Distinctions, which have been awarded mostly for gallantry in attending the wounded under the enemy's fire: to Officers —

Victoria Cross 8; Distinguished Service Order 580; with Bar 97;
Military Cross 1616; with one Bar 194; with second Bar 20;
with third Bar 1:

to Warrant Officers, Non-Commissioned Officers and Men —

Military Cross 30; Military Medal 3330;
Distinguished Conduct Medal (including 10 with Bar) 419;
Albert Medal 2; Meritorious Service Medal 1692.

The Victoria Cross was awarded to Captain H. Ackroyd, M.C., M.D.; Captain W. B. Allen, M.C., M.B.; Captain N. G. Chavasse, M.C. with Bar, M.B., killed; Captain J. L. Green; Captain H. S. Ranken, killed; Capt. J. F. Russell, killed; Lieutenant G. A. Maling, M.B.; and Lieutenant A. Martin-Leake, with Bar added.

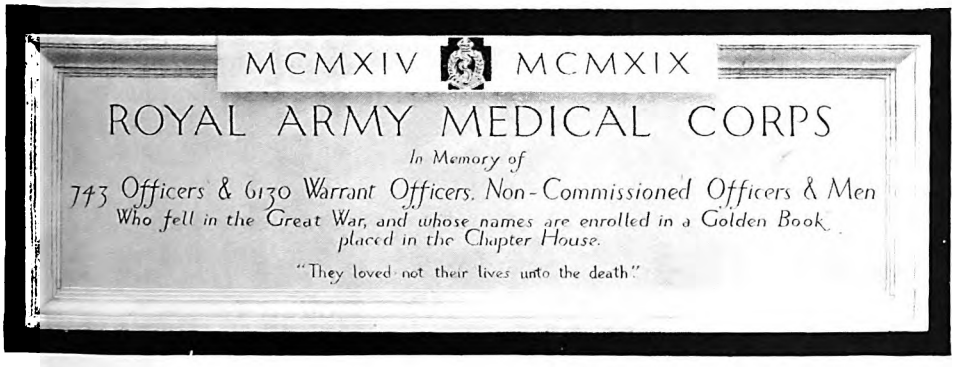
These awards attest the gallantry, skill and devotion to duty with which all ranks of the Corps endeavoured to carry out their great task of dealing with the sick and wounded of the enormous forces engaged, and at the same time maintaining the health and therewith the fighting efficiency of the troops committed to their charge throughout the course of a war unprecedented.

FOLLOWS THE ROLL

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The unveiling of the Tablet in the Abbey, and the presentation of the donation to the Abbey Fund by H.R.H. the Colonel-in-Chief, on July 13, 1922, was made the occasion of a Ceremonial Memorial Service. This was attended by H.R.H. Princess Christian, by representatives of the departments of State, of the Navy, Army, and Air Force, and Nursing Services, and of all the Universities, Medical Schools and Corporations, as well as by a large gathering of the Army Medical Services, and of all ranks and branches of the Corps, together with some hundreds of bereaved relatives—a total of about twelve hundred persons, filling the floor capacity of the nave. A memorable feature of this great ceremony was the sounding of "Last Post" and "Réveillé" by the Corps buglers, from a distant part of the Abbey. We are much indebted to the late Dean, Bishop Ryle, and to all the Clergy, Choir and Staff for the admirable conduct of this Service.



Royal Army Medical Corps War Memorial, unveiled by Field-Marshal H.R.H. the Duke of Connaught, Colonel-in-Chief of the Corps, in Westminster Abbey, on July 13, 1922.

The Mural Tablet, though excellent in itself and appropriately placed near the tomb of the "Unknown Warrior," forms a very modest monument to our seven thousand comrades, and when, at a later date opportunity arose, we added dignity and beauty by inserting a Memorial Window in the "light" above it. This great window, some thirty feet in height, is the work of Mr. J. N. Comper, to whose hands the series of new windows lighting the North Aisle has been entrusted by the Abbey Conservators.

To quote the Abbey Dedication Service paper of Sunday, May 22, 1927 :—

"At the head of the window is a quatrefoil containing the shield of St. Edward the Confessor in the earliest form in which it occurs in the Abbey with its supporters of eagles' heads. Beneath it again is the Eagle of St. John the Evangelist.

The lights contain two large figures under canopies, both lights being framed with borders of the "martlets" from the shield and the crowned E; and having niches holding statuettes of angels and four smaller shields of the Confessor with the ancient shield of the Abbey and of St. Peter.

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In the left-hand light is the figure of St. Edward the Confessor (*d.* 1066). His left hand holds the ring which he gave to St. John who appeared to him in the disguise of a Pilgrim, and from the wrist of the right hand holding the Sceptre hang tablets inscribed with the opening words of the King's Charter to the Abbey.

In the right-hand light is the figure of Abbot Edwin (*d.* 1071). He is in his Benedictine habit and without the mitre and ring which belong to a later period.

Within the Canopy above St. Edward is a picture representing him touching for the King's evil: and the corresponding picture in the other light represents the giving of the ring to the Pilgrim.

The detail of the King's Crown and Sceptre and the statuettes of angels are taken from the window of Richard II, who showed his devotion to the Confessor to the extent of impaling his arms with his own.

This is the earliest of the series of windows of Kings and Abbots, and the period leaves less store of contemporary details from which to draw. Like the rest, it owes much to the suggestions of the late Minor Canon H. F. Westlake.

In front of the pedestals of the two large figures are tablets, held by angels, containing the words :—

(1) In Memory of The Royal Army Medical Corps of all Ranks

(2) Who gave their lives in the Great War 1914-1919.

And beneath these, again supported by angels, between the Royal Arms and the Union Jack, are the Badge and Motto of the Corps and the names of the principal countries in which they served from 1914 to 1919, viz., :—

France, Flanders, Dardanelles, Italy, Macedonia, Mesopotamia, Egypt, Palestine, Africa, Persia, India, Russia."

The reproduction, which we have been enabled to give through the courtesy of Messrs. Gale and Polden, affords but a slight indication of the magnificent colouring of the original. The artist, the recognized master of modern glass, has, with his knowledge of weathering, set his tones light, so that the whole increases in richness as the years pass. One eminent authority describes this window as "the finest thing which has been done since the Reformation." Future generations will know that we were not unmindful of the adornment of the shrine of our dead comrades.

We owe a signal debt of gratitude to the present Dean, the Very Reverend Foxley Norris, for the time and careful thought he has given in dealing successfully with more than one architectural obstacle to the full realization of our scheme.

In the new British Memorial Church at Ypres we have erected one of the heraldic windows there, dedicating it to the memory of the "R.A.M.C. and their Comrades the Regimental Stretcher-Bearers who gave their lives in the Great War."

Those of us who occasionally contrive to throw a hurried glance through

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the turmoil of traffic at the War Monuments of Central London, will perhaps agree that the abandonment of the original scheme was no great calamity. Our material monuments are, of their kind, of the very best; and if the purpose of such monuments is the reverent preservation of the Memory of the Dead, then no more desirable shrine can be found than Westminster Abbey.

ROYAL ARMY MEDICAL CORPS WAR MEMORIAL.

BALANCE SHEET.

Expenditure.	£	s.	d.
Westminster Abbey, Restoration Fund ..	10,000	0	0
,, ,, Memorial Tablet ..	375	0	0
,, ,, Dedication Expenses	69	2	1
St. Giles' Cathedral Tablet ..	470	0	0
,, ,, Dedication Expenses	33	15	4
St. Patrick's Cathedral, Dublin, Tablet	255	15	5
Q.A.I.M.N.S. Memorial Fund..	82	3	6
R.A.M.C. Fund, General Relief Branch	837	3	10
Auxiliary R.A.M.C. Fund ..	837	3	10
Westminster Abbey Memorial Window	1,604	0	0
,, ,, fixing of Memorial Window	111	7	8
Golden Book	2,524	3	0
Printing 2,000 copies of Roll of Honour	305	18	6
Insurance of Golden Book ..	16	15	2
Trust Deed	16	3	9
Audit of Accounts	10	0	0
To Royal Patriotic Fund Corporation	4,643	16	4
R.A.M.C. Fund for Annual Armistice Day Wreaths	120	0	0
Clerical Assistance	30	10	0
Sundries (Printing, Postage, Cheque Books)	40	3	0
	£22,383	2	5

Income.	£	s.	d.
Donations..	20,083	12	1
Interest an Deposit (less Income Tax)	838	17	9
Interest on Investments (less Income Tax)	777	10	0
Interest on Treasury Bonds (less Income Tax)	412	14	0
Tax recovered	270	8	7
	£22,383	2	5

H. B. FAWCUS, Lt.-Gen.
E. B. WAGGETT, Major (Ret.).
Joint Hon. Secretaries.

Audited and found correct.
W. R. BLACKWELL, Maj.-Gen.

February 13, 1930.

After completion of the works and the allocation of a small sum for the provision, in perpetuity, of wreaths for the Abbey on Armistice Day, a balance of some £4,000 remained. After consideration of the subject of Research Prizes, it was decided by the General Committee to expend this balance for the benefit of the bereaved, and in order to secure continuity

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it has been made over to the Royal Patriotic Fund Corporation for administration. To quote the deed of transfer: "The Fund is primarily for the benefit of necessitous widows, orphans and dependants of deceased officers, warrant officers, non-commissioned officers and men of the R.A.M.C. who served in the Great War and who married before August 21, 1921, and for such other purposes connected with the War as have been specially designated by the donors. The Fund is to be administered by the Royal Patriotic Fund Corporation under the general direction of the Director-General A.M.S. for the time being and a representative of the Fund is co-opted a member of the Corporation and elected to the Executive Committee:" and it may be added that H.R.H. our Colonel-in-Chief is Chairman of that Committee as well as being President of the Corporation.

Several cases have already received benefits, notably assistance in educational expenses, and the Secretary of the Royal Patriotic Fund, 28, Sackville Street, Piccadilly, will be glad to hear of necessitous cases.

Three or four vacancies now exist at the Royal Victoria Patriotic School, where the Royal Patriotic Fund provides free board and education for the orphaned daughters of soldiers.

Note.—The cost of the Ypres Memorial Window, £61 5s., was met by the Royal Patriotic Fund Corporation in accordance with the terms of the deed of transfer.

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Original Communications.

THREE YEARS IN CENTRAL ANGONILAND WITH THE SLEEPING SICKNESS COMMISSION.[1]

By Major-General D. HARVEY, C.B., C.M.G., C.B.E., K.H.S.,
Director of Pathology.

Mr. President, ladies and gentlemen,—When my friend, your President, Dr. Fleming, asked me to come here this evening and give you an account of some of my experiences in the Service, I very gladly complied, and for several reasons.

As I daresay you are aware there has been, since the war, a dearth of candidates of the right type for the Medical Services of the Navy, Army, and Air Force, and it has been put forward as one reason for this scarcity that the spirit of adventure is no longer to be found among the youth of this country. Such a plea might possibly be put forward for the older men who have passed through the great adventures of the World War—they quite conceivably have experienced all the adventures they want—but in view of the wonderful feats of flying, motoring and exploration which have been accomplished since the war, I prefer to think that it is not so much the lack of the spirit of adventure, but rather the lack of, or want of knowledge of, the opportunity for adventure which keeps the younger men at home. Given the opportunity the youth of to-day, to my mind, is just as ready for adventure and the open road as his predecessors.

Therefore, when considering the selection of a subject for my talk to-night it occurred to me that it might be appropriate and of interest if I gave some account of my experiences with one of the Royal Society Commissions for the study of sleeping sickness and trypanosomiasis in Central Africa. The idea at the back of my mind was that it might serve to demonstrate to those of you who are not already aware that the duty of a medical officer in the Army in peace time is not confined to seeing the morning sick, or a few hours duty in the hospital or office, but on the contrary, that the way is open for much interesting work and sport in out-of-the-way parts of the world which are inaccessible except to the heir to the Throne or the multi-millionaire.

The subject of my address has been given as "Three Years in Central Angoniland with the Sleeping Sickness Commission."

It so happened that in the year 1911 I was proceeding home on leave

[1] An address delivered to the Medical Society of St. Mary's Hospital, Paddington, February, 1930.

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after five years in India. As we passed through the Suez Canal I remember remarking that this was my third time of making the passage and that it would be a long time before I came east again. However, within six months I was out again and making the east and south passage once more, as before my leave had expired I received a telegram asking me if I would join the Commission about to proceed to Nyasaland to continue the work on sleeping sickness and trypanosomiasis already done in Uganda, and specially to investigate the new type of sleeping sickness recently discovered in Nyasaland.

I readily accepted. We embarked on the Union Castle s.s. "Gaika" at Marseilles on the November 9, 1911, our first port of call being at Naples, a most magnificent bay, with wonderful scenery, the great active volcano on one side and the island of Capri guarding the entrance. But the city itself, at close quarters, is disappointing, although the Aquarium and Museum are well worth a visit, and especially, and above all, the buried city of Pompeii, where one can see the ruts in the stones of the narrow streets, grooved by the chariot wheels and the mark of the left hand on the side of the stone drinking fountains where the Pompeians leant to drink.

The next point of interest was the passage through the Straits of Messina where we saw the ruins of the city, the result of the great earthquake in 1908. Little attempt had so far been made to rebuild the city for fear of fresh shocks, but since then the city has been entirely rebuilt, and in the last twenty years only minor 'quakes have occurred.

Then the Canal again, and at night with the great searchlight on the bow of the ship which lights up the sandy banks till, by contrast with the ultramarine of the sky, they look as white as snow. Eighteen hours in all, as a rule, it takes to pass through and only in the Bitter Lakes is it possible to put on any speed at all; frequently we had to "tie up" at the side to allow another steamer to pass. Only at certain spots in the Canal can two large steamers pass and one of them must be stationary, otherwise the steering is so difficult that one or other will ram the bank.

Then the Red Sea, which belied its name, because at that season of the year the climate although hot was not unduly so.

On our way we called at Port Sudan, the starting point of the railway to Khartoum, and one of the most out-of-the-way and remarkable ports in the world. On approaching from the sea nothing can be seen but sand and red-hot-looking hills of bare rock, with no sign whatever of vegetation, and beyond the desert stretching as far as the eye can see. But on nearer approach a few small houses, with red painted corrugated iron roofs, could be made out and some tall structures which turned out, on closer inspection, to be the jibs of some modern electric cranes such as one sees at well-equipped home ports. The ship moored alongside the stone jetty and the cargo was rapidly whipped out. We had a stroll round the place, but there was really nothing to be seen beyond a few shops run by Levantines of the usual type. I am speaking, of course, of twenty years ago, and I

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daresay changes have taken place; but the chief thing one noted was the contrast between the desert surroundings and the electric hoists.

Our next African port of call was at Mombasa—a very different proposition, because here one is getting very near to the equator, and a constant succession of thunder-storms gives a good supply of rain, so that the whole place is embowered in the green of palms and other trees. The harbour itself, called Kilindini, is at the back of the island, and the entrance between two high buttresses of coral is a most impressive sight, and you could, as the saying goes, toss a biscuit from the ship to either shore as she glides in under her own power.

On passing through the winding entrance a beautiful land-locked bay is opened up and here we anchored and transhipped the cargo to lighters and so to shore.

A peculiarity of Mombasa is that all the roads are deep in sand, so much so that it is quite impossible to walk or even ride on a donkey any distance, and locomotion is provided by means of light railways and trolleys. Every private house has its own branch line and private trolley. You jump on one of these and are propelled along by two strong Africans; when they come to the top of an incline they give you a push, leap on at the back and off you go, flying down, very often coming off the rails at the foot into the sand, but they lift you and your trolley back on the line and on you go again.

The most picturesque building to be seen is the old Portuguese fort; similar forts are to be seen all down this coast, at Mozambique, etc.

The island of Mombasa is connected by a long trestle bridge to the mainland and along this bridge the railway is carried. Trains starting from Mombasa climb up to the plateau and reach Nairobi in about thirty-six hours. In the early days Mackay of Uganda and his companions took two years to do the same journey on foot and only one of the white men of the party survived to reach their goal at Victoria Nyanza.

Zanzibar is not far off and we called there also. This is a most interesting place; a really ancient Arab city with fine tall white buildings, very narrow streets and most wonderful carved doors to the houses—nothing of the tin town about it. Another feature is the beautiful woods of clove trees which cover much of the island near the town. The only blot on the landscape is the Palace of the Sultan, which is a modern building in what I believe is called "rococo" style.

In the old days Zanzibar was the great outlet for the slave trade and the slave routes of East Africa came down to the coast near Dar-es-Salaam. You will remember the old *Punch* cartoon where Disraeli and the Sultan are shown dressed in Arab costume, and Disraeli is remonstrating with the Sultan for allowing the slave trade to continue, and the Sultan says "Ah! Sheik Ben Dizzi, Conservative Party very strong in Zanzibar." Indeed, so strong were the local Conservatives that it was only of recent years that the slave trade has been finally put an end to.

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Further down the coast we came to Port Amelia in Portuguese East Africa, a wonderful natural harbour, but, as is the habit of the locality, entirely left to nature. The harbour has a diameter of nearly five miles of deep water with a narrow land-locked entrance and could shelter the entire Fleet with ease ; but there are no docks, no quays, no cranes, except those of the ornithological variety, and only a few scattered houses. This description refers to twenty years ago, but I heard from a friend who had visited the place a few years ago that conditions are unaltered. There was a proposal to build a railway from here up to Lake Nyasa, but nothing has yet come of it.

A few days later we approached the coast again at Chinde, but all we could see was a line of breakers and a few palm trees. We anchored a few miles off the coast and were taken ashore in a powerful tug. Chinde is one of the navigable mouths of the Zambesi, and at that time was the only one. On approaching nearer the coast we saw that there was a long sand-bar with the rollers breaking on it. We rounded a point and passed in behind the bank into the fresh water of the river and anchored a few yards from the beach, where we could see a few corrugated iron sheds and houses.

As soon as the boat came alongside I felt quite at home, for everyone spoke with a broad and unmistakable Glasgow accent. The reason for this is interesting. Originally, as you may know, Nyasaland and the Zambesi were first opened up owing to the travels and exploration of David Livingstone, the Scottish missionary doctor, and in his footsteps came other missionaries sent out by the Scottish Church Mission, the headquarters of which were in Glasgow. After a time the commercial side of the enterprise became so extensive and complicated that the Society were no longer able to cope with it, and a company was formed which was called the African Lakes Company. This Corporation was, and is, a trading corporation, pure and simple, but the majority of the directors were men who had been interested in the Mission Society, and the headquarters remained in Glasgow. The local officials were recruited from the Glasgow offices, and, although many of them had been for years in Africa, they still retained the homely accent.

Chinde, of course, is in Portuguese territory, but for customs purposes a strip of sandbank is leased to Britain, and on this we and our baggage were landed, and from this place we embarked on the river steamer for the long journey of some 150 miles up the Zambesi to the mouth of the Shire river. These river steamers are small double-deck stern-wheelers, with a dining saloon and small, very stuffy cabins in which one attempts to sleep under a mosquito net, for the steamer is tied up at night to the bank at wooding stations, so-called because owing to an absence or scarcity of coal the boiler fires are fed with logs of wood which are stacked at certain places on the bank and are obtained from the limitless and primeval forests in the vicinity of the river.

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This long river journey is now somewhat out of date, because a railway has been built from the port of Beira to a point on the bank of the Zambesi opposite the mouth of the Shire River, from whence the railway now starts for Blantyre. But there is no bridge across the Zambesi, and the difficulties of building it are colossal, as it would require to be some seven miles in length. This will give you some idea of the tremendous volume of water that comes down in the rainy season; but when we voyaged up it was the dry season, and, although the river was not at its lowest, still we spent a considerable portion of our time on sand-banks, from which we were pushed and pulled by an army of naked Africans who kept up a continual uproar to frighten away the crocodiles

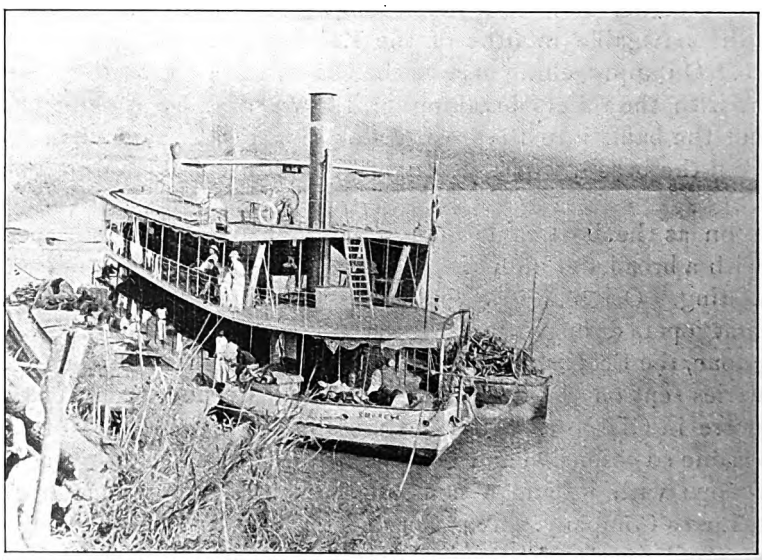


FIG. 1.—Zambezi river steamer tied up at wooding station.

and hippopotami. We saw many of these animals on our way up, but no game. The bird life of the river was most interesting, many varieties of duck and geese and thousands of flamingoes and egrets being seen, the latter perched on the reeds on the bank. The whole country here is flat and liable to flooding at certain seasons, and the few huts we saw were built on high platforms.

We visited Chapanga on the way up, the Portuguese mission station run by the White Fathers, men who come out to this country and devote their lives to the mission work, rarely if ever leaving the country again. Many of them have been here for thirty and forty years, and many more have died of malaria and blackwater fever. At this station we visited the grave of Mary Moffat, the wife of David Livingstone the explorer.

Another interesting place was one of the huge sugar plantations on the

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banks of the river, where they grow their own sugar cane, and here we saw some of the enormous tractor ploughs being drawn across the plain of black cotton soil and making furrows about two feet deep.

The white people here, of whom we saw a few, were in a very bad way with anæmia, the result of constant attacks of malaria. We were told that the life of a white employee at that time on the station was a brief one. No one apparently escapes malaria for long.

On arrival at the mouth of the Shire, a much smaller river, after a voyage of a week, we disembarked and got on to what are euphemistically called house boats. These are large flat-bottomed punts with a corrugated iron structure amidship and two benches along the sides. You sleep on

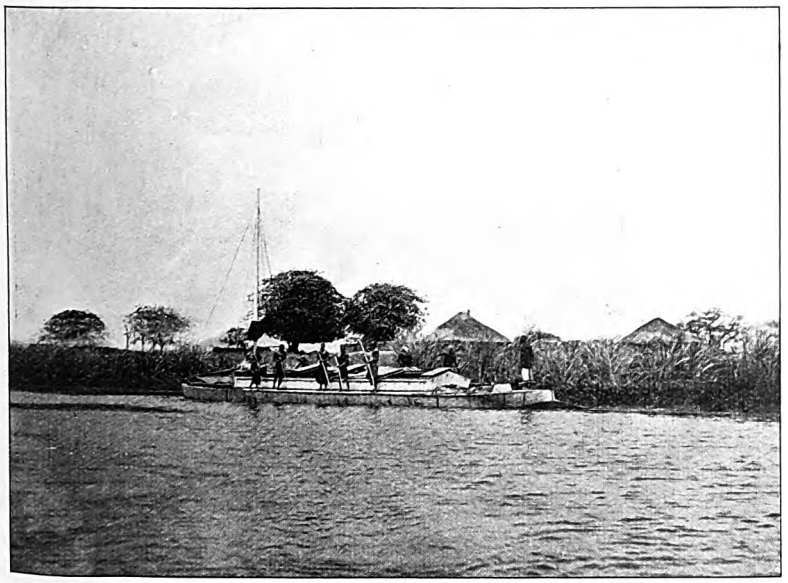


Fig. 2.—Barge on upper Shire river.

these benches at night, or try to, and sit on them during the day and fit up a table for meals. The locomotive power is supplied by several stalwart negroes who pole the ship along and accompany the effort with deep-throated melody. This poling and song go on all night, so that, combined with the hardness of the bench, sleep was not easily obtained. In addition, the mosquito-nets provided were full of holes not intended by the manufacturer, and as the lower Shire country is said to be, and I believe with truth, one of the most malarious districts in the world, it was not exactly conducive to restful sleep. However, the days were amusing and interesting as we passed up the river between high banks of reeds on which the white egrets perched. There were numerous villages on the banks, the entire population turning out to cheer us on our way.

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On arrival at Port Herald, where the navigable part of the river ceases and the foothills of the Shire Highlands begin, we boarded the train and in a few hours arrived in Blantyre, the chief town of Nyasaland, although not the capital, for that position is occupied by Zomba, about forty miles further on by road and situated still higher in the hills.

Blantyre is a pretty little spot, with many bungalows and a very fine locally-built and designed cathedral. We spent some days in Blantyre, getting our things unpacked and repacked for the march of 120 miles to the foot of Lake Nyasa.

The first stage to Zomba was by a fine road which winds over the plain; it was very agreeable after the Zambesi trip, as we were now nearly

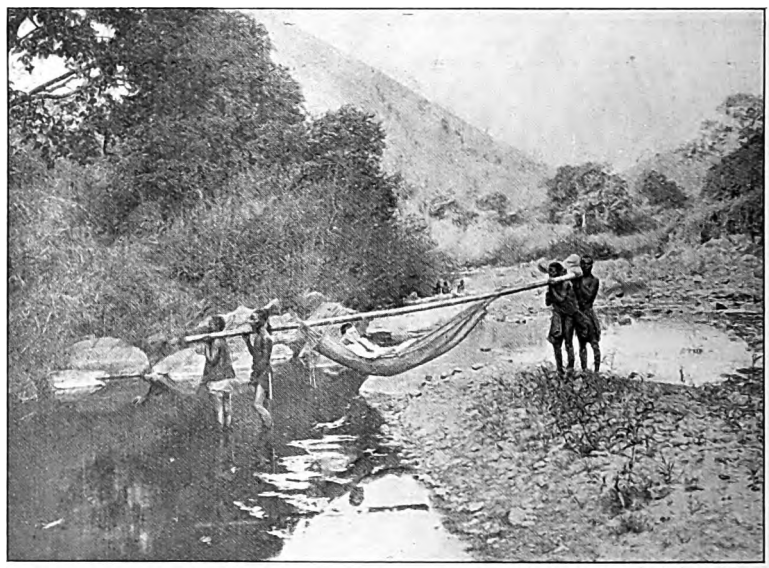


FIG. 3.—Crossing a stream by machila.

5,000 feet above sea level, and the climate was most pleasant, and mosquitoes few and far between. The only method of conveyance in those days was by rickshaw or by motor-cycle and side-car. There was one motor in the country, or rather cycle-car, but it was a standing joke. Nowadays roads go everywhere, and motors complete journeys in hours which took days to accomplish before.

At Zomba we again had a stay of a few days to collect carriers for our baggage—all our baggage had to be packed in appropriate loads to be carried on the heads of native porters—and to consult the various authorities, especially one or two of the medical officers who had actually seen and treated cases of the new form of sleeping sickness which we had come to investigate. We also saw some slides showing the parasite, and various collections of local flies—tsetse, tabanus, etc. We also visited the very

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excellent hospital, and indeed, owing to scarcity of accommodation, two of us were given beds in a ward, and very comfortable we were.

The next stage of our journey was by a narrow road, and we set off, some on bicycles (push) and some in machilas. The machila is a hammock slung from a long bamboo pole, the ends projecting six feet or so beyond the hammock and supported on the shoulders of six stalwart bearers, three at each end. These men move along at about five miles an hour, with a peculiar shuffling gait, in broken step, so that the occupant hardly feels the motion. However, the effect is somewhat spoiled, because every hundred yards or so the leader hits the pole a violent blow with the palm of his hand, which is a signal for the change over from one shoulder to the other (you can tell a machila-man at once by the callosities on his shoulders). This changing over process effectually prevents you from sleeping in the hammock, and is also assisted in this by the wonderful singing which goes on most of the time, and especially as one nears a village, when all the women run out and yell at the pitch of their voices and the machila-men chant their songs. Usually a tenor voice leads in a solo, and then a deep chorus comes in at intervals, and they have the most tremendous chest notes, as you may have learnt from our local music-hall friends Layton and Johnson. Owing to ignorance of the language, it is not possible to say what the songs connote, but some of the old hands told us it was just as well we could not.

The two-wheeled ricksha is another means of transport, but is unsuitable for the narrow bush track, and some people use a single-wheel chair which is run by means of a long pole, with a native at either end to keep it on an even keel.

We stopped the night at the first post, known as Liwonde, on the road to the Lake. It is almost on the lake level, that is, about 1,500 feet above the sea, and is a very hot, steamy and malarious place. When I awoke in the morning, I counted about twenty Anopheles mosquitoes perched on the *outside* of my mosquito net, and as this net was a local one, there were several large holes, but fortunately none of my friends had spotted these.

The journey from Zomba to Liwonde is, as you may have surmised, all down hill, and magnificent views of the vast forest on the plains, of the distant mountains in Portuguese East Africa, and of the great Lake, can be got from various turns on the road. But after leaving Liwonde the road is dead flat all the way to Fort Johnstone on the upper Shire river. This river and especially this part of it is interesting, as it is an instance of a very rare kind, in that the river flows in one direction at one season of the year and in the other direction at another. The explanation is that in the rainy season the lake level rises and the water flows out into the river and on into a huge marsh situated some miles away. A much smaller river flows out of this marsh, reminding you, I daresay, of the blood-supply of a glomerulus of the kidney with large afferent vessel and small efferent. In the dry season the lake level falls below that of the marsh and the water

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then flows back up the river into the lake again. At the same time water continues to flow out of the marsh at the lower end down the falls to Port Herald and thence along the lower Shire river to the Zambesi and the sea.

Fort Johnstone is situated on the river and about five or six miles from the Lake which has receded in recent years, because when the fort was really a fort it was on the Lake shore. Now the place is just a collection of a few corrugated iron bungalows, shops and sheds. The smaller lake steamers anchor in the river, the larger ones in the bay at the lower end of the Lake.

To describe Lake Nyasa is not easy. It is nearly 400 miles long and 25



FIG. 4.—On the lake shore near Domira Bay.

broad at the broadest point, and when one is afloat it is like a great sea with low palm-fringed shore on the western side and high mountainous shore on the eastern or Portuguese shore.

The voyage to Domira Bay, which took two nights and a day, was most interesting, especially one's conversations with the skipper who had been on the Lake for twenty-five years, and his mate, the engineer, who had been there an equally long time. Their stories of the old days were most interesting; neither of them had been home for many years and neither intended to go back again.

Domira Bay provided a good anchorage, but there were no houses or settlement there, so we landed early in the morning and did the thirty miles to our station, Kasu, by the afternoon. The first ten to fifteen miles

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was all dead level and then a gradual rise to 3,500 feet above sea level, 2,000 feet above the Lake. We passed through many large villages on our way, and also passed directly through the sleeping sickness area and the fly-belt, although at that particular time of the year the flies were not very numerous. So far as we could see the people seemed very cheery and fit and greeted us with much clamour.

On our way we passed through the Mvera Mission, of the Dutch Reformed Church, and met the doctor, Dr. W. Murray, who was one of the first to note the presence of the new disease. Indeed, it was the case of one of the inspecting missionaries which drew attention to the local area of infection. This officer came up from South Africa on a short stay. He



Fig. 5.—Director's house at Kasu.

paid one visit of a few hours one forenoon on a shooting trip in the fly area, was bitten on the back of the neck by a fly; at the site of this bite a painful boil developed; a week later he had fever, and a few days later numerous trypanosomes were found in the peripheral blood. He died about three months later.

Sleeping sickness had for years been epidemic in Uganda, but there was little or no trade or communication between that country and Nyasaland, and up to 1908 no cases had been reported in Nyasaland, but in that year the first case was reported in West Nyasa and investigations were at once set on foot by the local medical officers. One of these, Captain Hardy, R.A.M.C., seconded to the Colonial Office, contracted the sickness. He was certain that he was bitten by an infective fly whilst trekking along the

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Lake shore and near Patsanjoka, a very large village close by Domira Bay, which stretches for some miles along the Lake. The Chief here in our time was a woman. Hardy died of sleeping sickness at Aden on his way home.

In addition to the cases of Captain Hardy and the European missionary just referred to, nearly 200 cases had been detected in Nyasaland, most of them in the Domira Bay District, that is, the tract of land which lay before us as we looked out from Kasu towards the Lake.

The site selected for the work was at Kasu hill, near the edge of the Angoniland plateau, in view of Lake Nyasa. A magnificent panorama stretched before us from the verandah of our house of the tsetse fly infested

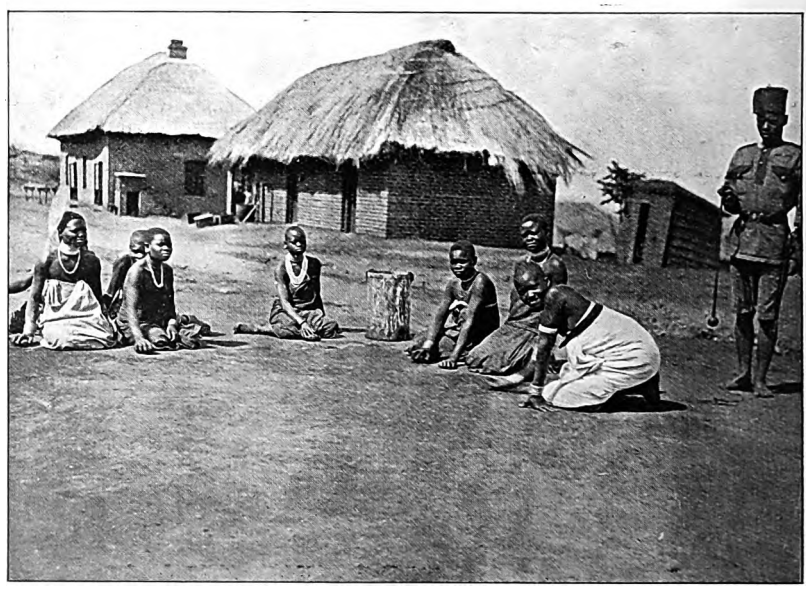


FIG. 6.—Putting a finish on the tennis court. Laboratory in background.

plains, lying between the Lake shore and the hills, and it was in this fly area that our future work lay.

Kasu itself was on a fly-free plateau, and behind us stretched a huge plateau area which was also fly-free.

The experimental station we found all prepared for us. One large building, built of local brick and thatched with grass, was the laboratory, and four smaller houses provided accommodation for the members. There were also stores and animal houses.

Apart from the Mission, the nearest station was at Dowa, eighteen miles away, where there was one European officer, his wife and two small boys.

The main object before the Commission was to inquire into the relation

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of the African fauna to the maintenance and spread of trypanosome diseases in man and his domestic animals.

In this connection a question to be studied was with regard to the tsetse fly itself. We already knew that the carrier of the disease in Uganda was *Glossina palpalis*, whereas, so far as was known, this particular species of tsetse did not exist in Nyasaland, the common tsetse fly of that country being *G. morsitans*, a fly which is widely distributed all over tropical Africa and is not like *palpalis* confined to the Lake shores and the margins of the rivers, but is widespread in large "fly belts" and may be met with far from any water.

When we arrived at Kasu the rainy season had just commenced and the whole bush country was soon covered with high grass and dense vegetation, rendering the pursuit and capture of game quite impossible in that area. Accordingly we started out at once on the study of the local tsetse. The methods employed were as follows: Kasu itself was not suitable for fly-breeding on account of the temperature conditions, so we formed a fly-breeding station at Chunzi, on the edge of the sleeping sickness area in the low country and a few miles beyond the Mission station. At this place there was a Boma, or official residence, which had been specially built on account of the sleeping sickness, and although the buildings were no longer in use they had all been left standing.

The method of capture of the flies was as follows: We employed about six native boys from the villages, and supplied them with fly nets; they wandered through the bush country, which at this season was full of fly and soon collected a large number. These were placed in special wooden boxes, about 8 inches by 3 inches, one end of which was formed by a glass slide and one side of netting. The flies could be observed through the glass and were fed by placing the box, net side down, on the experimental animal. Unless the flies are fed with blood every two or three days they die off. The tsetse is peculiar in that it does not lay eggs, but deposits a single living larva, which creeps about for a few minutes till it can burrow into the sand or debris, where it at once pupates. We collected these pupæ from the boxes and transferred them to special boxes until the imago, or full-fledged fly, emerged. We were thus able to obtain a supply, although a limited one, of laboratory-bred flies, and in the experiments to be described later on I shall refer frequently to the flies caught in the bush as "wild" flies, and to the others as "laboratory-bred" flies. An interesting point which emerged was that all boxes of fifty or more "wild flies" were shown to contain infective flies, whereas none of the laboratory-bred flies were ever found to be infective until they had been fed on an infected animal and the period of incubation or development had expired, i.e., there was no evidence whatsoever of hereditary transmission.

After a stay at Chunzi, when sufficient boxes of wild flies were obtained, usually about fifty to sixty flies per box, they were transferred to Kasu, in the fly-free area.

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It was, of course, necessary to exclude all possibility of chance infection of experimental animals by wild flies. Thereby hangs a tale: on occasions we had some dogs (the local pariahs) for experimental purposes brought up from Domira Bay and provided fly-proof cages for their transport. These cages were supposed to be carried by two natives, but we found that in spite of this most of these dogs developed trypanosomiasis a few days after arrival at Kasu. On inquiry we found that the natives objected to carrying

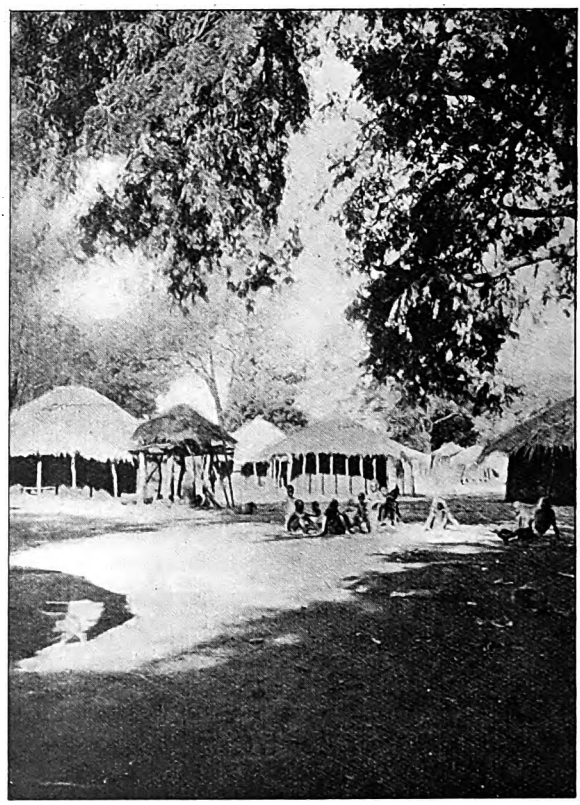


FIG. 7.—Village in sleeping sickness area.

dogs about the country. They have a great contempt for the dog and treat him badly. They said "Is the dog a Chief or Bwana (big white man) that we should carry him?" and their custom was to carry the empty boxes along while the dogs trotted after them, and incidentally got bitten by tsetse. This march from Domira Bay, although only of a few hours' duration, almost invariably resulted in infection of the dogs.

It is interesting to note, on the other hand, that none of the men who carried these boxes through the fly country became infected, and only one of our fly-boys contracted trypanosomiasis, and the village where he lived

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was actually in the fly area. Also one Musa, a hunter, died of sleeping sickness later on.

There were many monkeys in the area and the natives captured a number of these for us for experimental purposes. None of these animals was found to be naturally infected on arrival at Kasu, although all, except baboons, were shown to be readily susceptible. Apparently they owed their immunity to "nippiness" in preventing the flies biting them.

When the fly boxes arrived at the hill the wild flies were fed on a goat, a dog and a monkey, each box of flies being fed for three days on each type of animal. The result was, briefly, that practically all these animals sooner or later showed the presence of trypanosomes in their blood. At first we had great difficulty in differentiating these, for many of the animals showed two or even three different types of trypanosomes at the same time. But after some weeks, and even months, of close study of these forms, and by subinoculation into rats, guinea-pigs and rabbits (of which we had brought a supply)—animals which were immune to some strains and not to others—we were at length able to arrive at the following conclusions :—

That the common types of trypanosomes of Africa were all represented in the local fly. These were :—

(1) The polymorphic trypanosome of Africa, *Trypanosoma brucei*, which, as you will hear later, is similar to *rhodesiense*.

(2) The small monomorphic trypanosome which causes cattle disease in all the fly belts of Africa, generally known as *T. pecorum*.

(3) The large, blunt-headed type of trypanosome which is especially destructive to the local goat, *T. vivax* or *T. caprae*.

(4) A new and unknown trypanosome, monomorphic and resembling *pecorum*, but easily distinguished by its size and virulence for certain animals. This trypanosome was named for the first time *T. simiæ*. It also occurs in Rhodesia and Northern Africa, and is especially virulent for the domestic pig and also for monkeys, hence the name. This trypanosome was separated off from the others, primarily by reason of its virulence for monkeys, swarming in their blood and killing them in a few days before other trypanosomes could multiply.

You will see, therefore, that already we had incriminated the local tsetse fly as the vector or carrier of *T. brucei*, a trypanosome virulent for animals and morphologically and by animal experiment indistinguishable from *rhodesiense*, the human trypanosome of Nyasaland and Rhodesia, and three other species of trypanosomes virulent for cattle, goats and pigs, and so we could already say that the fly country was dangerous for man and his domestic animals.

Having thus differentiated the trypanosomes from the fly, we then obtained some strains of the trypanosome from the local human cases. These were sent to us from various parts of the country, usually by blood inoculated into white rats; but in one or two instances we were able to get the cases brought to the hill, as a small hospital had been established

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not far from us, and we took the blood from a vein and inoculated various experimental animals.

The clinical type of the disease was definitely different from that seen in Uganda, where cases went on and on for months and even years, eventually passing into the "sleeping sickness" stage, whereas in Nyasaland the cases were very rapid and acute in their course, with high fever, very numerous trypanosomes in the blood, œdema of the face, and death in about four to five months. All the cases so far reported had died.[1]

We then found that comparing the morphology of the strain of polymorphic trypanosome obtained so easily from the local tsetse fly with that of the strain obtained from the human cases of sleeping sickness, we were quite unable to separate them in any way. Both showed the long, slender, free flagellated forms, and both showed the short, stumpy forms with the so-called posterior nuclei in equal amount. The two strains from the fly and from the human being were also identical in their action on experimental animals; no difference in virulence could be made out.

The only test we did not carry out was to inoculate man with the game strain to see if it was pathogenic or not, but as you will hear later on, that was actually done.

The question now before us was this: were all these polymorphic *brucei* types of trypanosomes—that is, the common trypanosome of Africa in game and in the fly—pathogenic for man, or is there another, and much more rare, trypanosome, identical in appearance and in virulence for animals, but differing only in that it is pathogenic for man, whereas *brucei* is not?

These two strains—*brucei* and *rhodesiense*—it may be added, are quite easily separated from *T. gambiense*, the cause of sleeping sickness in Uganda, by differences in morphology, marked differences in virulence for experimental animals, and a different insect host.

Now we were at first inclined towards the first theory, that the common polymorphic trypanosome of Nyasaland was the trypanosome which was causing the disease there, and that all flies carrying this trypanosome were dangerous for man; against this theory was the fact we soon demonstrated, that very many flies were infective, but that actual cases in man were few and far between. This might be explained by: (*a*) Missed cases; (*b*) only a few susceptible people.

Against the latter view was the fact that anyone who was infected became very rapidly dangerously ill, and all died. There was no variation in clinical type.

Dr. Taute, a German investigator, visited our camp, and he held the contrary opinion, namely, that there were two identical types: one pathogenic for man, the other not, and that the common fly and game trypano-

[1] The disease in Uganda might be correctly called Sleeping Sickness, whereas the disease in Nyasaland might be more accurately described as Human Trypanosomiasis.

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some was non-pathogenic for man. He had the courage of his convictions, because he went across the Lake to a sparsely populated part of the country where no case of the sickness in man had been reported, and where game and fly were numerous. There he set up a small laboratory and collected boxes of flies; these he fed on dogs, monkeys and goats, and showed that they were infective and that they were capable of infecting the animals with the three common species of trypanosomes—the polymorphic *T. brucei*, *pecorum* and *vivax*. He then fed these same boxes of flies on himself, but without effect, and later, when fed on further experimental animals, they again infected.

This remarkable demonstration could only be put aside by saying that

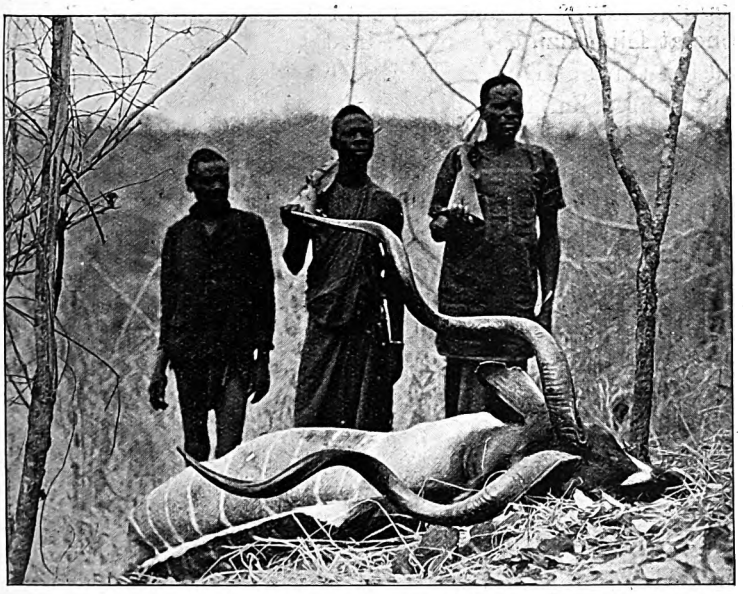


Fig. 8.—Fine koodoo bull shot in the foothills just on edge of fly belt.

Dr. Taute was immune to the disease; but later on, after our Commission had returned to England, Dr. Taute repeated the experiment and fed infective flies on over one hundred natives and also on himself and two assistants, and none became infected. Recently Dye, in Nyasaland, has shown on epidemiological grounds that human cases of sleeping sickness are in all probability infected only from other human cases, the vector, of course, being the tsetse fly. What becomes of the parasite when such an infective fly bites an antelope is not known. We quite clearly showed that antelope can be readily infected by the human strains. It is just possible that passage through the game may reduce its virulence for man just as passage through the goat reduces the virulence of *T. simiæ* for monkeys and pigs, and in that way the game may act as a "buffer" for man.

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A few months later, when the whole country was dry and much of the grass had been burned, we were able to take up the second part of our investigation, namely, to find out if the local game harboured trypanosomes, and we set about this investigation as follows :—

The sleeping sickness area was full of game, because in the last few years since the sickness had come the few white settlers had left the area and no one was allowed to come in there on shooting trips. As a result the game had multiplied rapidly, and there were great herds of waterbuck, hartebeeste, and many eland, reedbuck and bushbuck and koodoo; also, just as the antelope had increased, so had the large carnivora which prey on them, and lion, leopard and hyæna were numerous.

This country was easily reached from Kasu, and it was decided to make three shooting camps in the fly area; one at Chunzi, our fly-breeding station, one at Lingadzi, the deserted estate of a Polish exile, Stebliski by name, and the third at Domira Bay. Chunzi and Domira Bay were on the edge of the fly area, but Lingadzi was right in the middle of the most dense fly country.

The method was that one of our party went down to one or other of these places with house boys, hunters and fly boys, and went out early each morning and shot a variety of game just as they came. A fresh sample of blood was taken and put into a phial of sterile citrate solution, and slides were also made from the blood, both thick and thin films. These were at once handed to a boy who rode a motor cycle and who was waiting on the nearest path, and he set off at once for Kasu with the samples. As soon as he arrived the citrated blood was inoculated into two or more experimental animals, usually a monkey, dog and goat, and these animals were afterwards examined until trypanosomes showed in their blood. The slides made from the blood of the game were also stained and examined, and any trypanosomes discovered were noted and identified where possible. But as usually only a single trypanosome was found in a slide, and these slides were made under difficulty in the bush with the dust and heat around one, it was not always possible to identify the type of trypanosome; but when the inoculated animal "took," this was at once possible.

The shooting trips, although they had a considerable element of risk, were most interesting, and Colonel Hamerton (now Prosector at the London Zoological Gardens), then a Captain, and myself, who were the juniors, were always glad when it came to our turn, because it afforded a welcome change to the long hours of microscopical work which we put in at Kasu.

I had one very interesting stay at Lingadzi, a very fine house, but all deserted and rapidly becoming overgrown and destroyed by white ants, a fate which awaits every house in Central Africa left to itself even for a month or two. There was very dense bush all round up to the edge of what had been the cultivated area, where pineapples grew in profusion, the river, now just a dry sandy bed with deep holes dug here and there by the

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natives to obtain water, was within a hundred yards. My first night at Lingadzi I proposed to sleep on the verandah, as the nights were very hot down there near the Lake, but my boy said I must not or the "chirombo" would get me. I knew that chirombo in the local language meant a "pest," and was applied to all pests, from a flea to an elephant, and, incidentally, trypanosomes. But in this case it meant a lion, of which there were many round about. So I put my camp bed inside in a very stuffy room, and just as I was dropping off to sleep I was aroused by a low growling noise which gradually swelled to a muffled roar. I thought the



FIG. 9.—Buffalo bull in dense bush in fly country.

chirombo had come for me all right, but on looking out discovered that the old watchman of the estate, who had lost his job when the house was deserted, having heard that the "bwana" (white chief) had returned, had come back and taken up his old nightly post in a large tree and was beating a huge drum in a crescendo to keep the chirombos away.

To avoid the risk of being bitten by the fly as much as possible we used to wear a helmet cover of net which hung down over the back of the neck, the site of election of the tsetse bite for white people. This we could only wear when on the motor cycle, and it was when riding rapidly through the forest that most tsetse attacked, as they invariably follow a moving object, such as game. But when walking through the bush and stalking game it

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was not possible to wear these on account of the heat, so we used to trust to fly-whisks to keep the flies off, but in the excitement of the chase these were often forgotten too.

As a contrast to the missionary referred to, who spent but a few hours in the area, was bitten once and only once by a fly and developed the sickness, we can take the case of one of the local Commissioners, a colonial official whose headquarters were at Chunzi and who spent many months in the area walking about in shorts, a singlet, and socks, and terai hat, and was bitten not once but many times and never contracted the disease. He was an unusually powerful man, an international football player, and once attempted to stop a small baby elephant on a bush path ; he was knocked



FIG. 10.—Bush buck in thick fly country near Lingadzi.

head over heels into the bush with a dislocated shoulder. A year or two later we heard that he had been killed by a charging rhino. It was said that one of his predecessors in the job, like a wise man, used to employ from village to village a fly-proof cage carried by natives, and I saw the cage at Chunzi.

I had one exciting experience while shooting near the Lake shore. We always set off very early on our shooting trips, just before dawn ; this for two reasons : the big game are still on the move—as soon as the sun is up and light becomes strong they go into the dense thickets and are difficult to find ; also the tsetse bites only by day and in the very early morning is sluggish and not inclined to follow one. As soon as the day warms up they attack fiercely. We thus managed to escape the greatest risk of bites.

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One morning, just as the dawn was breaking, as I was moving along in open ground near the edge of the forest fringing the Lake, I saw a large animal moving away about 200 yards ahead of me. I followed quickly and the animal, which I could now see was a lion, crouched down on the side of an ant-heap. I dropped down also on another ant-heap about 80 yards away. The lion was hunting a small gwapi or duiker (an antelope) and I could see that he was just about to spring. I fired and the bullet went with a thud into the ant-heap. The lion turned and came straight back at the flash of the rifle; about mid-way between our two ant-heaps there was a patch of thick grass about ten yards across, and into this he disappeared and stayed still. I could not see him. My boy, who was



Fig. 11.—Eland bull shot in a clearing where the grass has been burned in dense *morsitans* bush.

carrying a small and very erratic Mauser carbine, a relic of the South African war, said we would walk him up, so we advanced across the open. Just as we reached our side of the cover there was a roar and the lion came out across our path with one tremendous bound which carried him about thirty or forty feet towards the cover of the forest. As he was at the top of his bound, at least ten feet in the air, I fired again as one would fire at a bird, but missed, and two more bounds carried him to the trees and out of our sight. It was lucky he chose to make for cover and not for us.

Lions were very numerous in the district and we were told that in the course of a year many natives had been carried off out of the villages, the lion leaping the high fences, seizing the unfortunate native and again leaping over the fence carrying its victim.

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At one station I was shown the skin of an enormous lion which was full of spear holes. This lion I was told had been killed in the following way. Two young sportsmen of the village persuaded their aged mother, a very wiry and nimble old lady, to sit in the doorway of their hut while they climbed on the roof and pulled the door up in two slots and fixed it open; they waited under cover on the roof. Shortly after the lion came along, charged across the open and leapt straight at the old woman; she flung herself to one side and the lion shot into the hut and the door was promptly dropped down into the opening. The two men then speared the lion to death through holes in the roof.

The plan of collecting samples of blood from game in the low country

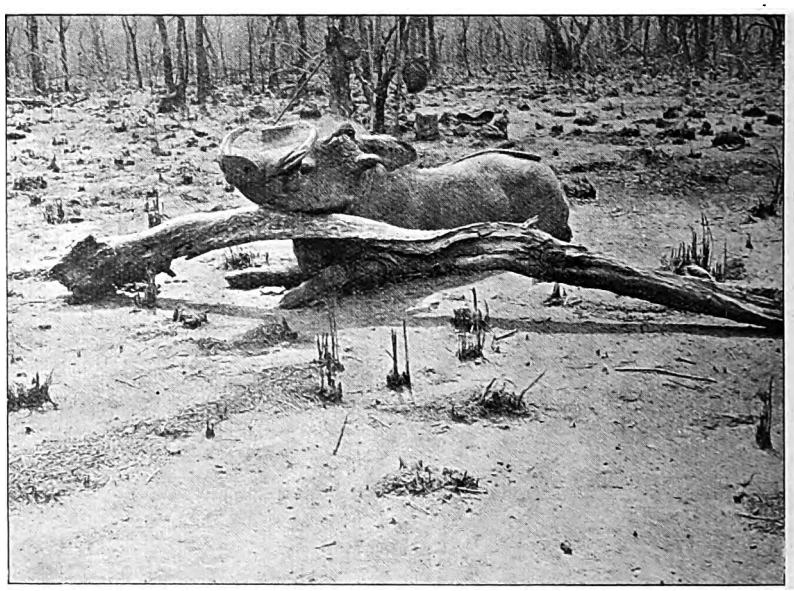


Fig. 12.—Wart hog in similar country.

and sending them up to Kasu worked well, and in a very short time we were able to show that practically all the big game in the dense fly area is infected with trypanosomes, but these are never numerous in their blood and do not in any way affect the health of the animals; these trypanosomes were identified as exactly the same as already found in the fly, namely *brucei*, *pecorum*, *vivax*, and *simiæ*.

Actually in a few months we shot and examined nearly 200 head of game, and 31·7 per cent were shown to be infected, by means of blood-culture and slide examination.

One interesting find was that the only animal from which we were able to isolate *simiæ* was the wart hog, and this trypanosome was most extraordinarily virulent for the small domestic pig, killing it in three or four days after inoculation. The wart hogs were not affected.

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Coincidentally with these experiments we worked out also the development of the parasite in the fly. It had already been shown in Uganda that the trypanosome goes through a definite period of development in the fly. This was proved as follows: Boxes of twenty or so laboratory-bred flies were fed first of all on clean animals, then for two or three days on an infected animal, then thirty days each day on a clean monkey, using a different animal every day. It at once became apparent that, providing conditions of temperature and moisture remained fairly constant, the first ten to fifteen day animals would escape, whereas the animals fed on or after that period would all become infected, and the box of flies would remain infective till they had died out or at least the infective flies had died. Usually about five or six per cent would become infective.

On pursuing this investigation by dissection of the flies, certain flies were found, in the first week after an infected feed, whose intestines were swarming with flagellates differing in many ways from the parasites as seen in the blood of the animal fed upon. They were much larger and many curious forms could be seen; but no flagellates were found anterior to the mid-gut or in the salivary glands. But after the tenth day still other curious forms would be found in the proventriculus, and after the fourteenth day the trypanosomes would be found swarming in the salivary glands, and here and here only would they be of the blood form and ready to re-infect on being discharged down the hypopharynx, the termination of the salivary duct, which opens far forward in the proboscis. When the fly bites, the first thing it does is to inject some salivary fluid which contains an anti-coagulin and an irritant, and which renders the area congested and enables the fly more readily to obtain a feed of blood.

What happens then, so far as *brucei* and other trypanosomes of the polymorphic type are concerned, is that certain forms of trypanosomes are sucked in with a feed of blood. In certain flies these start at once to divide and multiply (in others they simply die out); they multiply till they fill the gut, then pass forward into the proventriculus, where a different type is formed; from thence they pass forward into the proboscis and up the hypopharynx into the salivary glands, where again they multiply, and from here and here only, in the case of *brucei*, the infective or blood form of trypanosome is found.

Now as this development had never been fully worked out for *pecorum*, *vivax* or *simiæ*, we set out to trace it and soon found that although a box of flies might be infecting animals and therefore must contain infective flies, we could not find on dissection any trypanosomes at all in the salivary glands of the flies, and in the case of *vivax*, none in the gut either; whereas in flies infected with *pecorum* and *simiæ*, the gut was swarming with parasites of the developmental type. It was noted as differing from flies infected by *brucei* that numerous forms were seen inside the labrum—that is, the tube of the proboscis—and on closer dissection the infective forms

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were found at last massed in the hypopharynx, but never going up higher into the salivary ducts or glands.

The method that led us to this discovery was as follows : We took a box with, say, ten flies which were infecting animals with *simiæ*, and we divided these into two boxes of five and usually found that only one box still continued to infect. We then put each of these five flies into separate glass tubes with gauze over one end of the tube and fed the flies singly until we had tracked down the infective fly or flies. We then held a cover-slip on the tip of a finger and pressed this against the gauze end of the tube ; the fly bit at the finger and deposited on the glass the infective juice from the proboscis. This was fixed and stained and the trypanosomes of the infective or blood-type were readily demonstrated along with a few of the proventriculus type. On dissecting the fly, no infection was found in the salivary glands, but a very careful inspection of the proboscis showed the blood or infective forms in masses all along the hypopharynx, the inner tube of which is the continuation of the salivary ducts. It is obvious that in this case also the salivary juice is necessary before the final change into the infective form is possible.

As regards *vivax*, the heavy-headed goat trypanosome, the interesting discovery was made that this trypanosome does not develop in the gut but is confined in its development entirely to the proboscis, the first change taking place in the outer portion, or labrum, and the infective forms appearing in the hypopharynx.

All this work on the fly was not easily done, or readily done, but took us many months of close and difficult work before the final explanation appeared, and the result of this work now gives another method of differentiating trypanosomes :—

(1) Those that develop in the gut and salivary glands of the fly.
(2) Those that develop in the gut and proboscis of the fly.
(3) Those that develop in the proboscis only.

Examples of :—

(1)	(2)	(3)
brucei.	*pecorum.*	*vivax.*
gambiense.	*simiæ.*	*capræ.*
rhodesiense.		

Note.—A fly in the wild state may be doubly infected and infective with *vivax* and *brucei*.

Summary.

The main conclusion that emerged from our work was the obvious one that the fly was dependent on the game for its food, that if the game disappeared the fly would also disappear, and that until the fly disappeared it would not be possible for man or his domestic animals to live in the fly areas.

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The much-disputed question, whether *brucei*, the common game trypanosome of Africa, is able to infect man, we had to leave unsettled ; but since then, as I have indicated, it would appear that the ordinary game trypanosome is not infective for man, and that, as has been demonstrated in so many other diseases, it is a case of man-to-man infection. Yet there must have been a time when the game trypanosome first became "acclimatized" in man, as the human trypanosome is now for animals.

A day or two ago I asked one of the leading authorities on protozoa whether *brucei* and *rhodesiense* were one and the same or distinct, and he replied, "I do not know."

By the time we got thus far it was getting on into 1913, and coming events were casting their shadows before. Several letters had been received, hinting that if we hoped to be in at the start of the coming war we had better get a move on or we might find it all over before we got home. So I, personally, came home in November, 1913, and the work of the Commission finally ceased in May, 1914, having started in 1911.

But although the Commission ceased to exist, the work went on. It is true that during the war much was in abeyance, but since then the work has gone on apace in Zululand, Nyasaland, Tanganyika, Rhodesia and Uganda, and many of the questions set by us have been finally answered, but many still remain for you to answer.

Note.—The photographs shown in this paper are all from proofs supplied by Captain A. E. Hamerton, D.S.O.

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CANTONMENT HEALTH ADMINISTRATION.

By Major A. E. RICHMOND, O.B.E.
Royal Army Medical Corps.

An officer of the R.A.M.C. or I.M.S., serving in India, is liable at any time in the course of a tour of duty in that country to find himself called upon to carry out the duties of a Health or Assistant Health Officer in a cantonment, either permanently during his stay in the station concerned, or temporarily, in the absence on leave, or from some other cause, of the official holder of the appointment.

The proper performance of such duties involves a knowledge of cantonment health administration with special reference to its legal aspect, and it is the object of the writer, while not laying claim to putting forward anything original in his article, to bring to notice as concisely and clearly as he can points of importance in regard to the matter alluded to, in the hope that some measure of assistance will, perhaps, be afforded to some of those readers who may at some future date be called upon to assume the responsibilities of a cantonment Health, or Assistant Health Officer. Even if no such help is given, the author hopes that the article, though ponderous in many parts on account of the legal aspect of the subject with which it deals, will serve to show to a material extent the importance of the duties assigned to medical officers holding appointments of the nature mentioned.

Before settling down to a consideration of the subject in hand, it is as well that readers should remember that there is a wide gulf between the conditions existent in India fifteen years ago, or less, and those found there to-day, and that the average present-day Indian, a lover of litigation and perhaps impatient of anything savouring of the British Raj, will endeavour to escape any obligation placed upon him, other than in a strictly lawful manner, with the result that a Health or Assistant Health Officer may find himself haled into court, if any act of his, performed probably with the best will in the world, has not been accompanied by attention to any legal formalities that may have been necessary.

The population of a cantonment varies, I suppose in most cases, from ten to twenty-eight thousand souls, of which often a quarter only comprises troops, the remaining three-quarters consisting of civilian Indians of every kind of caste and every degree of wealth and poverty, who obtain their livelihood out of the needs of the soldiery and of their fellow residents. The health of this conglomeration of persons depends in great degree on the energy, foresight, and tact of those health authorities with whose responsibilities this article mainly deals.

The dictionary definition of the word "cantonment" is "quarters for troops," and the majority of cantonments in India date from the days of

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the East India Company. For military and health reasons they were placed outside the cities concerned, though at no great distance from them, and in many cases there is practically direct continuity between the two. The influence exerted on the health of a cantonment by the neighbouring city is, naturally, in almost direct proportion to their proximity.

There is no doubt that the size of the large civilian element of the cantonment populations has grown enormously as time has passed, not only on account of the fertility of the average Indian lady, but also owing to the immigration of people who find life pleasanter and less toilsome in a well-ordered cantonment than in an overcrowded Indian city, with its occasional outbreaks of turbulence and other disorders, and its periodical epidemics of such terror-striking diseases as smallpox, cholera and plague.

The administration of a cantonment is normally in the hands of what is known as the Cantonment Board, the composition of which is usually as follows :—

(*a*) The Cantonment Commanding Officer.
(*b*) The Health Officer.
(*c*) The Executive Engineer.
(*d*) Such military officers, not exceeding four in number, as may be nominated by the Commanding Officer.
(*e*) A magistrate of the first class nominated by the District Magistrate.
(*f*) Civilian members elected under the Cantonments Act and equal in number to those appointed under clauses (*b*) to (*e*).

As regards cantonments situated within the limits of a presidency town, in Baluchistan, or in the North-West Frontier Province, certain modifications in the composition of their boards are authorized by the Cantonments Act, this also being the case in respect of those having a population of under 2,500 persons.

These variations in constitution are designed to meet special local conditions not met with in cantonments in general, and it is not proposed to discuss them in further detail.

Apart from the Board referred to there is, in all cases, an official known as the Executive Officer, who is appointed by the Government and whose post is a whole or part-time one, according to the size of the cantonment concerned.

He is responsible to the Board for seeing that its instructions are carried out and that the provisions of the Cantonments Act are complied with, for exercising a general supervision over the cantonment employees and their work, and over the cantonment in general, and for the performance of numerous other duties. In addition, though not a member of the Board, he acts as its secretary and has various obligations in that connexion.

It will be realized that the duties of the Executive Officer are multifarious and onerous, and it is with him that the Health or Assistant Health Officer is sure to have many dealings. A spirit of friendly co-operation

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between these health officials and the Executive Officer necessarily spells much benefit to the cantonment concerned.

In 1924, with a view to consolidating and amending the law relating to the administration of cantonments, the Cantoments Act was passed and is applicable to the whole of British India, including Baluchistan. This very important measure is a long one of some seventeen chapters, comprising 292 sections, and a working knowledge of its provisions is very essential to anyone who is called upon to deal with the direction of a cantonment from a health or other point of view. On this account the author considers it desirable to devote most of his attention in the course of this article to a consideration of the matters, referred to in the Act, which are germane to the subject and, with a view to a clearer conception of these being obtained, they are placed under separate and reasonably appropriate headings, together with references in brackets, where necessary, indicating the section or sections of the Act applicable.

Finally, to conclude what one might term a general survey of the subject of cantonment administration, it is as well to mention that the money necessary for the normal municipal activities of a Cantonment Board is found from the Cantonment Fund, and that this has numerous sources such as rates, taxes, etc., from which it gains financial nourishment.

Let us now turn our attention to the more strictly health aspect of the direction of a cantonment.

I.—The Duties of the Health and Assistant Health Officer.

The Health Officer is, normally, the senior military medical officer in the station, and his duties are defined in the Cantonments Act (s. 129).

He is responsible for exercising a general sanitary supervision over the whole cantonment, and must submit monthly to the Cantonment Authority a report as to the sanitary condition of the area under his surveillance.

The Assistant Health Officer is selected from one of the military medical officers doing duty in the station, and should, preferably, have had previous experience in hygiene and be possessed of a diploma of public health. He frequently combines the duties of Assistant Health Officer and Medical Officer in charge of the Cantonment Hospital, referred to later.

His responsibilities are such as are allotted to him by the Health Officer, subject to the control of the Cantonment Authority (s. 129).

It will be noted from the foregoing that the obligations of the two health officials mentioned are stated only in very general terms, but it should be borne in mind that, throughout the Act, reference is made in numerous places to certain specific duties which will be alluded to under the appropriate headings.

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II.—Water Supplies.

In every cantonment where a sufficient supply of pure water for domestic use does not already exist, it is the responsibility of the Cantonment Authority concerned to provide or arrange for such a supply, and it is laid down that it must, as far as possible, be continuous throughout the year and be at all times pure and fit for human consumption (s. 217).

The Cantonment Authority directly controls any sources of water, within or without the cantonment, used for the benefit of the inhabitants, except such sources as are under the jurisdiction of the Military Works Services or the Public Works Department, or are under the direction of or owned by some private person.

In the latter case the Authority is empowered under the Act, by notice in writing, to ensure that the source is kept free from contamination and in good order, and should the individual concerned not take the necessary steps and the water be not fit for drinking, its use for such a purpose may be prohibited by the Board. In the case of a well, however, the owner may, at his own request, be absolved of responsibility in the matter, the onus of its proper care and maintenance falling upon the shoulders of the Cantonment Authority (ss. 218 and 219).

In the event of a building not being provided with a water supply, adequate for the needs of those in residence or employed in it, the owner, lessee, or occupier can be compelled by the Cantonment Board to obtain a sufficiency of good water from the public source and to provide the necessary communication pipes (s. 221).

The Board has, under the Act, wide powers in regard to the supply of water and is entitled, in this connexion, to carry pipes through, across, over or under any road, street, land or building, or up the side of any structure within or without the cantonment boundary, while, in addition, it may do anything necessary to keep such pipes in proper repair, provided that no nuisance, in excess of what is really necessary, is caused in the execution of the work, and that compensation is paid, should damage to property result (s. 227).

If the Cantonment Authority is of opinion that the water in any well, tank, or other place is likely to spread disease, it may, by public notice, prohibit its removal or use for drinking purposes and, by notice in writing, require any person who has control of such a supply to prevent the public from having access to it, while it may in addition take any other steps considered expedient to prevent the outbreak or spread of such a disease (s. 169).

Under the same section, in the event of a cantonment being threatened by an outbreak of any infectious or contagious disease, the Health Officer or any person authorized by him may, without notice, at any time inspect and disinfect any source of water supply, and may further put in force any measures he thinks fit to ensure the purity of the water or to prevent its use for drinking purposes.

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It would not appear necessary to offer any detailed comment on the provisions of the Act referred to dealing with cantonment water supplies, and it suffices to say that they give the Cantonment Authority full control in this very important matter within the cantonment, and also all jurisdiction outside it, necessary for the prevention of water-borne disease, and that the special powers given to the Health Officer in a threatened epidemic of an infectious malady are of particular significance as far as we are concerned.

III.—Conservancy and Sanitation.

It will be realized that, in any ordinary cantonment, lack of funds and other circumstances do not permit of anything in the nature of a water-carriage system of sewage disposal, and reliance has accordingly to be placed on other and cruder methods.

A daily house-to-house collection of filth and refuse is also impossible in most places, with the result that what we may describe as the "group system" of conservancy has to be depended upon. Under such a scheme refuse dumps, suitably constructed, and latrines and urinals together with destructors, are placed throughout the cantonment, in the most convenient situations as regards the groups of houses, bungalows, and other buildings they are intended to serve. These public latrines and urinals are used by the bulk of the cantonment population, only the bungalows and larger Indian houses having private arrangements of this nature; the filth from those places, with their own conveniences, is carried daily to the nearest group latrine for incineration in the destructor attached to it.

Household refuse is carried each day to the nearest dump, and from these it is collected by small motor lorries or ordinary carts, the former type of conveyance being much the more desirable from both an economic and sanitary point of view.

The drains existing in a cantonment are usually of an open type and intended for the disposal of storm and rain water, but sullage water, which it is not easy to deal with satisfactorily, frequently gains entry to them and may cause trouble if the channels are not kept well flushed and clean; similarly, excremental matter will of a certainty find its way into the drains from time to time, a most undesirable state of affairs, and one which requires to be guarded against by the punishment of those concerned.

It is the duty of the Cantonment Authority to keep all public latrines and urinals in proper order and to provide the necessary conservancy staff (s. 130); it may, too, with the consent of the occupier, or without his concurrence where he fails to make satisfactory conservancy arrangements, undertake the scavenging of any building or land for such a period as it thinks fit on any terms it deems necessary (s. 131).

The obligation of providing public receptacles in suitable situations for the temporary reception of household refuse, carcases of dead animals and the like, lies with the Cantonment Authority, as also the responsibility for

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its proper disposal (s. 132), while the Act lays down specifically that the Executive Officer may, by written notice, require the lessee or occupier of any land or building to close a cesspool which is productive of nuisance, keep any rubbish or sewage depository in a clean condition, prevent the water of any private latrine, urinal, or bathroom from entering any water-course or drain not intended for the purpose, or from flowing on to a street or public place, and to collect for removal by the conservancy establishment any offensive matter or refuse which such an individual has allowed to accumulate. The official mentioned may also compel any person to desist from making or altering any drain leading into a public channel, and to cleanse, modify, or put in order, as necessity dictates, any drain of which he is in control (s. 135).

It is a circumstance of some considerable moment that when any well, tank, cistern, reservoir, receptacle, or other place in the cantonment where water is stored or accumulates is creating a nuisance, or when in the opinion of the Health or Assistant Health Officer a place of this kind is dangerous on account of the presence of mosquito breeding, or of the likelihood of its occurrence, the Cantonment Authority may enforce any filling up, closure or drainage that may be requisite (s. 134).

In the hands of the Board lie important powers in regard to enforcing the provision, by an owner or lessee of a building or land, of any latrine, urinal, cesspool, dust-bin or other rubbish or sewage receptacles which are required, while any employer of more than ten workmen, and every person controlling a market, school, theatre, or other place of public resort may be called upon to provide such sanitary conveniences and personnel as the Cantonment Authority deems adequate to the purpose (ss. 135 and 136).

Finally, the Board is given under the Act the means to ensure that any private latrines or urinals are constructed or altered according to the approved official plan, and are not taken into use until they have been passed as suitable by the Health or Assistant Health Officer, that a private convenience of the nature referred to, which constitutes a nuisance is closed, and that the owner or person in control of any drain in the cantonment provides such a covering for it as may be considered necessary.

Here, again, the Cantonment Authority is given practically unlimited powers, and the uninitiated will wonder why it is that the average cantonment is not a model of cleanliness, even though the system of conservancy and sanitation is not exactly up to date. They must continue to speculate until we look further into the matter later on in the course of this article.

IV.—Buildings.

The significance of any provisions of the Cantonments Act dealing with the matter of buildings and housing will be clear to all those who have had any experience of the average Indian cantonment, with its over-large proportion of badly built ill-ventilated habitations. A large part of Chapter XI

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of the measure referred to has regard to this important subject, and probably no section is of greater moment than that dealing with congested buildings. Here it is laid down that, when it appears that any block of buildings in a cantonment is in an unhealthy condition, by reason of their crowding together, narrowness of the street, want of proper drainage or ventilation, or the impracticability of cleansing them, the Cantonment Authority may have them inspected by a committee consisting of the Health Officer, the Civil Surgeon, the Executive Engineer, and two non-official members of the Board, and may take any action indicated as necessary by the Committee's report in regard to the removal of all or any of the buildings, provided that due compensation is paid to the owners concerned (s. 138).

The Board also has the right to deal with the overcrowding of buildings by causing the individuals responsible to reduce the occupants to the maximum allowable (s. 139).

Owners of buildings, so badly constructed or dilapidated as to be in an insanitary state, may be compelled to execute any repairs, or carry out any modifications that may be requisite for the purpose of removing the defects (s. 140), while the Executive Officer may require the owner, lessee, or occupier of any building or land in the cantonment which appears to him to be in an insanitary condition to put the matter right within twenty-four hours. A repetition of the offence within three months renders the person responsible liable to a fine of not more than 200 rupees (s. 141).

Turning now to the matter of buildings or parts of them intended for or used as human dwellings, and which are unfit for habitation, we find that the Cantonment Authority may have a notice posted on such places, prohibiting the owners or occupiers concerned from applying them to the purpose alluded to, or allowing them to be so used until rendered satisfactory (s. 142).

The Board is given very definite control over the erection or re-erection of buildings and their alteration, and no work of this nature may be completed without official sanction. This has special reference to modifications of places by which, though not intended for the purpose, they may be converted into human dwellings, and, in an opposite sense, to changes by which erections intended for human habitations are converted into stables, cowsheds and similar types of shelters; also to cases where alterations involve an increase or decrease in the heights of buildings, or the reduction of floor or cubic spaces below any standards laid down by any bye-law made under the Act (s. 179).

Plans of new buildings or changes in existing ones have to be submitted for the approval of the Board, and the latter may refuse to sanction the work, or alternatively may give its approval, subject to certain conditions being complied with, these usually having respect to such matters as free passage way in front of, and space about a building, its ventilation and the

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cubic capacity of its rooms, and the provision of latrines, urinals, drains, cesspools, or other filth receptacles (s. 181).

The Cantonment Authority is empowered to make bye-laws in regard to housing, laying down, among other conditions, the type or description of buildings which may or may not be erected, or re-erected, and the minimum cubic capacity of any rooms (s. 186), and may order the demolition, or modification as necessary, of any building put up or altered without the necessary official approval of the plans (s. 185).

As regards drainage and sewer connections, the Board may compel the owner or lessee of any building or land at his own expense to put up and keep in good condition troughs, pipes, and the like for carrying away rain-water, or for discharging it, and to establish or maintain any other connexion or communication between the building or land and a sewer or drain, while in addition such an individual may be required, for purposes of efficient drainage, to pave in a satisfactory fashion any courtyard, alley, or passage between two or more buildings, and to keep the paving in proper repair (s. 189).

When we examine the powers of the authority concerned in relation to buildings just detailed, it is clear that the authority can deal, within reason, with any defective housing conditions existent, but, unfortunately, progress in this direction must of necessity be very gradual. The rectification of such conditions, inasmuch as they have frequently been present over a considerable period of time, usually involves much expense on account of compensation and other things, the bulk of which falls on cantonment funds, often not capable of shouldering the burden; while in a replanning scheme of any magnitude the difficulties of housing inhabitants, evicted to allow of the carrying out of the work, will on many occasions be well-nigh insuperable.

Some readers have probably been faced with obstacles of this nature in connection with, in particular, the abolition of regimental bazaars. The latter, occupied by shopkeepers, followers, etc., are in many instances situated within the regimental lines of the units they are connected with, and are a source of continual anxiety to the health authorities, owing to their liability to form foci of infection in regard to the spread of disease among the surrounding troops. Such bazaars within the lines should be cleared away whenever possible, and it should be borne in mind that grants for the purpose from the Government may possibly be obtained, if application is made and full and sufficient reason is given as regards the necessity for the proposed step.

Finally, and a point of some importance, is the fact that in many cantonments in past years building has not kept pace with the increase in population due to the natural fertility of the Indian and immigration, and consequently there is an already present marked degree of overcrowding which makes the remedying of defective housing conditions increasingly difficult.

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V.—Prevention of Infectious or Contagious Diseases.

Turning now to a consideration of this extraordinarily important side of cantonment health administration, we find in the first place that it is very clearly laid down under the Act that any person in charge of or in attendance upon, whether as a medical practitioner or otherwise, an individual in the cantonment whom he knows or has reason to believe to be suffering from a contagious or infectious disease, is responsible for giving information on the matter to the Cantonment Board, and is liable to a fine of not more than 100 rupees if he fails to do so or furnishes false information (s. 150).

In the event of a cantonment being visited or threatened by an outbreak of infectious disease, the Officer Commanding the district is given very wide powers, in that he may, with the previous sanction of the Local Government, take such special measures, or make such temporary regulations as he thinks necessary to prevent the outbreak or spread of the trouble. In urgent circumstances he may act without the approval of the Local Government, provided he forwards a report on the subject to that body, and it is of importance to note that any individual committing a breach of any temporary regulations made in this way is deemed to have offended under Section 188 of the Indian Penal Code, and to be liable to punishment accordingly (s. 151).

It is within the powers of the Cantonment Authority, on the advice of the Health Officer, to have carried out any necessary disinfection or cleansing in connection with the prevention of the spread of infectious disease, previous notice in writing being given to the owner or occupier concerned, who must see that the requisite steps are taken, unless poverty or other cause prevents him from complying, in which case the Board may have the work carried out at the public expense (s. 161).

In a similar manner the owner of any shed or hut may be compelled to destroy it if circumstances necessitate such a course of action, or, failing that, the Cantonment Authority may have it done away with, compensation in either event being payable by the Authority referred to. Temporary shelter or house accommodation must be provided by the Board for the members of any family dislodged by reason of the disinfection, cleansing, or destruction of their habitation (ss. 162 and 163).

A regulation is made in the Cantonments Act by which no building or part of one may be let if anyone has suffered there from infectious or contagious disease within the preceding six weeks, unless the place has been properly disinfected. It is of some moment to note that under the section of the Act dealing with this point it is specifically stated that keepers of hotels, lodging houses, and sarais are considered to let to any guest the part of the building in which he resides (s. 164).

Anyone who, while suffering from an infectious or contagious disease, uses a public conveyance, is compelled to take proper precautions against the communication of the infection to others, by notifying the owner or

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driver of the vehicle as to such use, while in addition the Executive Officer must be informed of the number of the conveyance and the particulars of the infectious individual. Similar action must be taken by anybody who uses a public vehicle for the carrying of anyone, alive or dead, suffering from an infectious or contagious disease.

The driver of a public carriage in which an infectious person or corpse has been taken is also responsible for reporting the fact to the Executive Officer, and it is this officer's duty to see that the vehicle is disinfected and not brought into use until this has been completed (ss. 157, 158, 159).

A fine of not more than 100 rupees is the penalty incurred for contravention of the sections of the Cantonment Act just referred to.

With respect to this matter of the conveyance of infectious persons in public carriages, it should be remembered that no driver of such a vehicle is bound to convey individuals suffering from infectious or contagious diseases, unless payment sufficient to cover any loss or expense which would ordinarily be incurred in the disinfection of the carriage is made in addition to the ordinary charge (s. 160).

Naturally, in the prevention of infectious disease, disinfection plays a highly important part, and cantonments authorities are called upon under the provisions of the Act to provide proper places for the purpose, together with the requisite attendants and apparatus, and must cause conveyances, clothing, or other articles brought with this object in view to be dealt with accordingly, either free of charge or on the payment of such fees as they may fix.

It is also within the power of the Cantonment Authority to forbid washing of infected articles at any but specially designated places.

The President of the Board or, where there is no Board, the Commanding Officer of the cantonment, has authority to direct the destruction of any clothing, bedding, or other articles likely to retain infection, and may cause such compensation as he thinks fit to be given (s. 166), while nobody may give, lend, sell, or otherwise dispose of to another person any article which he has reason to believe may have become infected and is likely to be used in or taken into a cantonment (s. 165).

It is now advisable that we should turn our attention to a consideration of the powers possessed by the Cantonment Board in regard to the control of food and water supplies on the outbreak, threatened or actual, of infectious disease.

If a medical practitioner attributes such an occurrence to milk supplied by a dairyman, and provided he certifies this as his opinion in writing, the Executive Officer is at liberty to call upon the milk seller concerned to furnish a list of all his customers, with a view to information being obtained as to the persons to whom the milk has been retailed (s. 152), while the Health Officer is at liberty to take charge of any milk, clothes, or other articles in possession of any implicated dairyman, and to have them submitted to any process of disinfection considered necessary, it being the

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responsibility of the Cantonment Authority to pay such compensation for any loss occasioned thereby as may seem to it to be reasonable (s. 156).

Apart from its powers in relation to the milk supply referred to previously, the Board may by public notice restrict in any manner considered necessary, or prohibit for such a period as circumstances make essential, the sale or preparation of any article of food or drink for human consumption, or the flesh of any animals (s. 168). It has also very wide powers in regard to the prohibition of the use of water from any specified source, the disinfection of wells, and the taking of any other steps considered expedient in connexion with the water supply, should it be of opinion that such supply, if used for drinking, is likely to engender or cause the spread of *any* disease (s. 169), while in this section just referred to it is also specifically laid down that the Health Officer, or any person authorized by him may, in an outbreak of infectious disease or a threatened outbreak, without notice and at any time, inspect and disinfect any well, tank, or other source of water, or carry out any measures he thinks fit to ensure the purity of the supply or to prevent its use for drinking purposes.

The Cantonment Act lays down that a fine not exceeding 100 rupees may be inflicted on any individual who, while suffering from an infectious disease or in circumstances in which he is likely to spread such a disease, makes, carries, or offers for sale any article of food or drink, or any medicine or drug for human consumption, or any article of clothing or bedding for personal use or wear, or takes part in such an act, or in the washing or carrying of clothes (s. 167).

In the event of the Health Officer certifying it as necessary with a view to preventing the spread of infectious disease, the Executive Officer may direct any washerman to provide him with a list giving the names and addresses of all owners of clothes and other articles which he has washed during the preceding six weeks (s. 153); he may also, on report from the Health Officer that infectious or contagious disease is likely to be spread by the washing of clothes in any place, or by any process employed by a laundryman, prohibit such washing or process for as long as circumstances render necessary (s. 155).

The Health Officer is empowered under the Act to take charge of any clothes or other articles in the possession of a washerman who has been called upon under Section 153 previously mentioned, and may have them subjected to any disinfecting process considered essential, responsibility for the payment of any compensation for loss or damage occasioned thereby falling on the shoulders of the Cantonment Authority, as in the case of clothes or other articles taken from dairymen under similar circumstances (s. 156).

The disposal of the corpses of those who have died of infectious diseases receives special attention in the provisions of the Cantonments Act, and we find that the Executive Officer may, by notice in writing, require any individual having charge of such a corpse to convey it to a mortuary to be

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disposed of in accordance with the law, or to prohibit the removal of any such dead body from the place where death occurred, except for the purpose of burial, or burning, or conveyance to a mortuary (s. 170).

Certain other powers of some moment lie to the hands of the Health Officer or the Medical Officer in charge of the Cantonment Hospital. Should either of the officials referred to believe any person in the cantonment to be suffering from an infectious or contagious disease, he may call upon the suspected individual by written notice to attend at the hospital or dispensary for examination at a specified time and not to quit it without permission. On the arrival of the individual the Medical Officer may examine him for the purpose of satisfying himself as to the presence or not of a disease of the nature alluded to.

Should, however, the attendance of such a person at the hospital or dispensary be likely to prove unnecessary or inexpedient, the examination may be carried out at his own residence, while in the event of an individual examined being found to be suffering from an infectious or contagious malady, the Health Officer or the Medical Officer in charge of the Cantonment Hospital may detain him until he is free from infection. Should such detention not be requisite or expedient, the Health Officer or Medical Officer referred to may discharge the person concerned and take such measures or give such directions as he may consider necessary (s. 175).

If the Health Officer or Medical Officer in charge of the Cantonment Hospital reports in writing to the Commanding Officer of the cantonment that any person having received a notice under Section 175 has omitted or refused to attend at the hospital, or dispensary, or has left it without permission, or has failed to comply with any directions given under the same section, the Commanding Officer may by an order in writing instruct such an individual to leave the cantonment within twenty-four hours and not to return to it without his written permission. A person so expelled is forbidden to enter any other cantonment (s. 176) without the express permission of its Commanding Officer.

No comments on the provisions of the Act in regard to the prevention of infectious and contagious disease appear requisite, inasmuch as these appear to be all-embracing and to give ample powers to those requiring them to deal with epidemic maladies.

Of particular importance is the fact that the District Commander may take any special measures considered necessary, and that the term "threatened epidemic of infectious disease" is capable of wide interpretation.

(*To be continued.*)

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THE CANTONMENT ANTIMALARIA PROBLEM. AFTERTHOUGHTS.

By Major T. O. THOMPSON,
Royal Army Medical Corps,
AND
Captain P. F. A. GRANT, O.B.E.,
Indian Medical Service.

A few months ago a series of random notes on the subject of this heading were submitted with the idea that they might form a suitable subject for discussion by a correspondence circle.

The notes were in no sense intended to be an authoritative treatise on the subject, but were in the nature of an invitation for criticism by others who had faced and solved or tried to solve this cantonment antimalaria problem.

Criticism or discussion, it was hoped, would bring to light other valuable points of view which would be a help in consolidating the opinions and efforts of others who are engaged in facing this problem.

Alas! little success has been achieved up to the present, as no critical discussion has as yet appeared in our Journal.

Major J. E. M. Boyd in the January number, 1929, has very kindly endorsed and to a certain extent amplified the points which were brought forward. More recently Major R. A. Mansell has dealt with the subject of the prophylaxis of malaria and has also written a direct criticism of the points raised in the series of notes. In the hope of further criticism and of eliciting the opinions of other experts the following notes, including some criticism of the points raised by Major Mansell, are put forward for consideration and possible discussion.

Afterthoughts are said to be of doubtful value, and Major Mansell, in September, 1929, in his article entitled "Some Answers to the Cantonment Malarial Problem," quotes Mr. Augustine Birrell to the effect that the abrupt asking of questions is "offensive"; it is therefore with considerable trepidation that we venture on further remarks on this matter. But as the original object was to raise a discussion from some of our other expert antimalariologists, and as that object has not yet been attained, we venture to inflict these afterthoughts, avoiding as far as possible the offensive asking of questions.

Far be it from us to decry any antimalaria work, which everyone knows is often carried out under extreme difficulties of climate, shortage of personnel, indifference or obstruction of inhabitants, and the clashing interests of different departments, work which often, in the face of many adverse factors, produces such excellent results.

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But our contention is that, with our cantonments such as they are, our results will be even better if we concentrate on spending most of the money available on "mass protection," while we continue also one or two of the most efficient antibreeding methods which are suitable to each locality or to the particular cantonment concerned.

Let the local antimosquito breeding methods include expenditure and work which is considered directly beneficial, or which is held to be a direct attack against the malaria vectors of the cantonment, but do not let considerable sums be expended out of antimalaria grants for mere minor repairs and works and schemes of drainage which, although they can remotely be considered to be of an antimalaria nature, should in reality be met from minor works grants and M.E.S. expenditure for the general upkeep of the station. Often items such as repairs to bridges, drains, gutterings of barracks, and so on, items which have no real bearing on the malaria incidence of the cantonment, are pushed into antimalaria schemes to secure the necessary funds. It is true that they can sometimes be considered to be of an antimosquito nature, but so often they are merely minor works and repairs which should be met from station engineer funds and are foisted on to the medical services as being the easiest method of obtaining the money. It is this expenditure which should be severely scrutinized, and the money so saved should be used in lump sums over a period of years in securing mass protection where it is considered that the best results will be obtained.

That antimosquito breeding work as such must continue in our cantonments, and that it has, does and will give excellent results in many cases is quite certain, but our object is to endeavour to show that our average cantonment is so placed and has such disadvantages that, although the local antimosquito breeding work is efficient, greater efficiency will be obtained by mass protection.

We will try to answer, if possible, the points raised by Major Boyd and by Major Mansell, and endeavour to make clear and amplify some of the random notes and "offensive" questions which had been previously perpetrated.

Major Boyd kindly agrees with us on the majority of the points which were put forward. He refers particularly, however, to mosquito surveys and the relative cost of malaria as shown by case incidence, also to fumigation and "spot-maps," and agrees that protection is a main stand-by, but quotes examples to show that the mosquito net is not an infallible protection, and agrees that the collective protection of proofed barracks is the ideal. On considering the points in detail the following afterthoughts arise :—

(1) On Mosquito Surveys and Malaria Surveys.

Major Boyd quotes the example of a survey carried out by himself at Lahore, and mentions his surprise at the astonishing number of breeding places which he found, although there was an energetic but overworked

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antimalaria officer present. He goes on to point out how inadvisable it would be for the orderly officer, staff surgeon, umpteen-other-duties officer, and antimalaria officer to be wandering round cantonments in the heat of a midsummer day. He suggests that for such surveys it is not necessary to have a medical officer, but that civilian help should be co-opted and that a central committee should be formed for the whole country with the A.D.M.S. and the S.M.O. as the local controlling agents. But he speaks of a district antimalaria officer, which implies more personnel, and this is just the one thing which at present appears to be so difficult to obtain and which means the extra expenditure of precious and limited funds. Also this scheme is surely in actual being even at the present, although perhaps, from Major Boyd's point of view, it is limited too much to military activity alone. We have the Director of Hygiene and Pathology in touch with the Central Institute at Kasauli with chains of A.Ds.M.S. and S.M.O.s, assisted by officers of the hygiene and pathology branches, the D.A.D.s of H. and P. and the officers in charge of laboratories. It is true that the actual carrying out of any mosquito survey usually devolves on the last-named, and it is just because they have so many other duties that the attainment of a proper mosquito survey is so difficult. Incidentally, these hardworked officers need leave during the hot weather just as much as anyone else, and this implies a change of personnel somewhere in the middle of the malaria season. Also many stations have no laboratory.

In 1927 Major G. Covell, I.M.S., published two excellent brochures on mosquito surveys, under the auspices of the Indian Medical Research Fund, which cover the distribution of anopheline mosquitoes throughout India and Ceylon. From these it is quite possible to obtain a very good idea of the malaria vectors present in any particular cantonment, but this of course will only form a rough guide to a basis for a proper mosquito survey of the cantonment on which to found the working details of the requisite anti-mosquito breeding scheme.

The question arises, what is that work to consist of and who is to be called upon to do it? Can the officer who is detailed as antimalaria officer keep himself completely *au fait* with the mosquito-breeding situation throughout the whole of the season? Can he keep control of all mosquito breeding in the cantonment area alone, apart from outside areas, to such an extent that this method can be relied on for reduction of malaria without recourse to any form of mass protection? It would seem from the difficulties which beset him to be an extremely doubtful proposition.

For schemes which are to produce any real results a continuity of policy over a course of years is an essential factor. The first item of any such continuous policy naturally is a survey on which to base ideas of expenditure and action. But can that survey be a complete malaria survey, or even a complete mosquito-breeding survey?

During the course of the last four to eight years it is true that in the majority of cantonments very definite schemes showing a continuity of

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policy have been worked out, and that these are based on malaria surveys of varying exactitude and on spot-maps of breeding places which are kept up to date from year to year. This information is available from the S.M.O.'s files for use by the antimalaria officer, and no doubt affords him a considerable amount of assistance in his work.

In a recent publication, "How to Do a Malarial Survey," by Colonel S. R. Christophers, Major J. A. Sinton, and Major G. Covell (*Health Bulletin*, No. 14, Malarial Bureau, No. 6, of 1928), the authors stress the fact that for any attempt directed towards the reduction of malaria, the work should be commenced by a malaria survey as contrasted with a mosquito survey. They say, "To take action apart from survey is to work in the dark. Surveys are the eyes and ears of malarial work and should be so regarded."

They also put the question, "When should a malarial survey be undertaken?" and answer it by saying, "Always, when it is desired to take any action in regard to prevention or amelioration of malaria in any circumstances whatsoever"; and again, "Malaria is of vital importance to those responsible for troops, whether stationed in cantonments or on active mobile service. Malaria survey is the only means by which the type of information required in these cases can be gained."

They particularly point out, however, that "a mere record of breeding may at times be useful, but it is not a malarial survey," and they go on to state in respect of malaria surveys that "when the facts have been fully elicited it is, however, the business of the malaria officer to give his *full* attention to this."

If the military antimalaria officer is hard put to it to keep in touch with antimosquito breeding work in his cantonment, surely he will find the giving of his full attention to a proper malaria survey an impossibility, and must rely on the gradually accumulated knowledge contained in the S.M.O.'s files and in previous schemes. If he is keen on his work, and if he can devote a reasonable amount of his time to it, he will undoubtedly add his quota to the general knowledge, but in very few cases will he be able to carry out a full and proper malaria survey.

A further point is the type and size of the staff required for a malaria survey. Can the average cantonment provide or afford such a staff year by year or at moderately frequent intervals? The authors of "How to do a Malaria Survey" give the details of the staff which they consider to be required for a small survey.

It consists of the following:—

Malaria Officer. They state that if possible he should be a medical man; this is opposed to Major Boyd's view. One sub-assistant-surgeon; one laboratory assistant, paid anything up to Rs. 60 a month; one insect collector, paid according to circumstances; one clerk; one chuprassi; one sweeper.

Apart from the possible difficulties of securing the actual personnel, the

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actual cost involved would be a very serious drain on the allotment for any average cantonment, and would seriously handicap the amount of preventive antimosquito breeding work which could be done.

Therefore it appears that in the average cantonment lack of funds alone will prevent the luxury of a full malaria survey, and that a saving of funds towards the production of mass protection will in the end give the most satisfactory results.

Major Mansell appears to think that we implied that we are not capable of carrying out mosquito or malaria surveys, and that they are not made in our average cantonment. It would be as well to make the point clear that with our present method of annual schemes and continuity of policy, records of numerous surveys do actually exist for the average cantonment. Mosquito-breeding surveys of past years are epitomized in the form of cantonment spot-maps, and are being added to little by little.

But it is not uncommon to hear inspecting or other advisory officers say, "What we really want is a thorough malaria survey of the whole cantonment."

Our point, however, is, in view of what is entailed by a complete malaria survey, can the antimalaria officer or the S.M.O. cope with a malaria survey or even keep abreast of a mosquito survey, in addition to his other duties, and hope that by such activities he is going to affect malaria incidence to any greater extent than has already been achieved, unless aided by the advantages of mass protection?

Remember that he is working with a constantly shifting population, in an area which is markedly limited in some respects, but potentially unlimited in others, and an area which is closely hedged about by other areas over which he has no control.

The incident quoted in the previous notes of the officer having a multitude of duties was an actual example, and occurred in a station of one brigade strength with a cavalry brigade in addition. That officer was actually O. i/c dermatological section, officer detailed for training of stretcher-bearers and sanitary squads of two units and the R.A., officer in charge medical wards, medical officer in charge two units and the R.A. Brigade, temporary staff surgeon *and* antimalaria officer. He was intensely keen on his antimalaria work, but was, in spite of protest, ordered in the middle of August to another district.

He certainly could not be in a position to complete any mosquito or malaria survey.

This is obviously an extreme case, but it appears to support the contention that under present condition, lapses in antimosquito breeding work must be covered by mass protection and that full malaria surveys can rarely be carried out.

In stations or cantonments in which mass protection, other than by mosquito nets, has not yet been obtained, and in which it is not likely to be obtained for some years to come for lack of money, it is obvious that

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efforts towards reducing or controlling the malaria incidence must be directed towards the prevention of breeding or the destruction of mosquitoes in the immediate vicinity of the troops concerned.

Major Mansell produces histograms of the malaria incidence of "one of the most malarial districts of north India," which show a marked diminution of incidence during the past three years. This he attributes tentatively to the results of expenditure on antimosquito breeding methods. It would be as well for us to remember that, on the whole, the last three years have been astonishingly favourable for a natural reduction of malaria in many parts of the country; particularly has this been the case for the year 1928; and to remember, also, that even now so little is known as to the wave incidence of malarial epidemics, that we cannot rightly judge results from three, five, or even possibly ten years, and that a rude awakening may be in store for us this year or the next.

(2) On the Cost of Malaria.

How should the cost of malaria be judged? Should we think of it in terms of the number of days lost, or the hours wasted per man, or are we to think of it in actual cash cost?

If we merely state that the cases of malaria are so many, this conveys little or nothing to other than medical minds.

If we turn this into hours wasted or the numbers of days' work which have been lost, we get a slightly better result which, however, does not really appeal to the layman and to those who control the purse.

If our figures are sufficiently startling, we may make some impression and cause a mild astonishment either at the wonders of malaria or at our wonderful statistical minds; probably the latter.

What we require for such a purpose is actual figures in the equivalent of hard cash. We want to be able to go to the purse-holders and say, "Look here, in such and such a cantonment the cost, the actual cost, of malaria during the last three years has been so much, we know that the antimalaria measures have cost so much, and that judging from the past three years this expenditure has reduced the incidence so much, and has produced a net saving of so much."

If the question of mass protection is to be taken up in any particular cantonment, we must be able to give comparative measures and results judged after a period of years.

Major Boyd in his article gives a series of figures of days lost. These figures are startling enough to show us the appalling ravages of malaria, but would they not convey much more to the lay mind if they were converted into cash costs? In commercial enterprises, such as tea and rubber estates, cost is of great importance and governs the whole procedure. The actual cash cost of malaria is balanced against the remedial cost and may be shown as a heavy debit.

The controlling authority can show that the enterprise is failing and

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that preventive measures will make it a paying concern; therefore all such preventive work is included as part of the running expenses of the paying commercial concern. For this reason the expenditure is readily granted.

With the Army it is very necessary to show, in the same way, how a certain expenditure will produce a definite saving, but we must be prepared to justify ourselves both on paper and by actual facts. Next comes the question of securing the necessary figures to use for our purpose, for impressing the lay mind of the purse-holders of the need for any particular antimalaria measures.

Figures of malaria are readily available, but can we guarantee that these figures really represent the true facts of the case? We have many returns in the Army which give us, and those in high authority, the reputed numbers of malaria cases. Can we honestly, in many a station, state that the figures shown do actually represent the number of cases of malaria? We think that a few years ago such a statement would certainly have been taken with a very large grain of salt, but in the past three or four years there has been much more of a tendency to admit cases and to show the real state of malaria.

It is no use for us to juggle with the figures in order to prove our case for demanding certain expenditure.

We must be honest and must show all cases of malaria if we propose to get a true picture from which to work.

In the past it must be admitted that there has been much hiding of cases by detaining mild cases or treating them in barracks. Such concealment may be done to avoid unpleasant "strafes" from higher hygiene branches, or merely with a view to keeping men at work, but this is an important consideration in judging between different stations and different hospitals.

The following story may illustrate the point:—

At a certain nameless station, a thorn in the side of the district, the Hygiene and Malaria Officer, and the O.C. British hospital went to see the O.C. Indian hospital about the very large number of malaria cases which were being admitted. The O.C. Indian hospital was the senior. He "pooh-poohed" the idea of much malaria and said, "Malaria, I can't understand it, here we are getting none at all; look at that chart, one case only in at present!"

At that moment in walked the O.C. of the local battery and said, "I have come to see you about the amount of sickness amongst my personnel. You have so many of my Indian drivers detained and marked 'attend C' that I really have not enough to carry on with. What can you do about it?" The O.C. Indian hospital sent for the Indian officer who was doing the medical work of this unit and asked what all this sickness was. "Oh, Sir" was the reply, "these are all those mild cases which you told us to treat in barracks; they are all malaria."

Surely then, we must make it a hard and fast rule that every single

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case of malaria is to be admitted and shown in returns if we are to get any real conception of the true state of malaria incidence, even though for a year or two our admission figures shoot heavenwards.

Another point in this connexion is, are we going to base our ideas of malaria infection on fresh cases, excluding relapse cases, or are we going to consider all the admission figures for malaria, believing that every hospital is admitting all cases of malaria? The distinction between a fresh case and a relapse case or a *re-infection* is extremely difficult and is certainly not a matter which any average medical officer can guarantee; and yet one sees, time after time, reports and returns where the small number of fresh cases is cited as evidence of lessened malaria, while the whole malaria figure probably remains the same. Surely then we must use the whole malaria figure to get any true picture of the incidence.

In many a station there is a marked discrepancy between the malaria rates shown by the British and the Indian military hospitals. We do not think that this can be due entirely either to a definite preference of the anophelines for the British areas of the cantonment or, on the other hand, to the intense acquired "immunity" (?) to infection of the Indian personnel in the cantonment. We think that the British hospital rates give a much truer picture of the real infection of the cantonment.

That malaria figures have been, and still are, colossal is very clearly set forth by Colonel J. Mackenzie, R.A.M.C., in his excellent résumé of the health of the Army in India in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS for November, 1928.

The results shown, even though the absolute accuracy of figures from some stations may be doubted, are quite sufficient to justify all efforts to secure the necessary expenditure on remedial measures and to produce hard-cash figures of the relative costs.

Having got our figures of the malaria incidence, how can we convert these into the relative costs? We must know the approximate cost of keeping one patient in hospital and off duty for the average time. We think that an average of seven days in hospital and a further ten days off full duty should cover the actual time lost. We now require figures from the pay department as to the actual cost of the up-keep of all our hospitals per patient per day, not merely the cost of food, etc., of the individual patient. Inquiry from a certain pay department elicited the figures of Rs. 11 for British troops and Rs. 9/8 for Indian troops per day. We suggest that these might be checked and the correct figures be circulated to all concerned. In addition to this we also require some idea of the value of a man's work and the loss to the State when he is off duty for sickness. This is a difficult item for the ordinary lay mind to determine. Perhaps it will not be overstepping the mark if we consider that for ten days off full duty it is a loss to the State of Rs. 25.

Having got figures of incidence and of relative costs for each case, we cannot merely say that, if 100 cases less are admitted for malaria, then we

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shall save 100 times the cost of one patient, because in the long run, even if those cases were not admitted, a proportion of the medical personnel and the hospitals would still have to be maintained.

We suggest that for purpose of formulating antimalaria schemes, it would be a great help if some general figure of the total cost of each malaria case could be obtained and circulated to all. This would give some idea as to whether the relative cost of the proposed remedial measures would give a possible saving.

Once we have the relative cash costs available we are in a much more satisfactory position for putting forward some essential scheme which undoubtedly will reduce malaria in our cantonments. An example of how this can be used may be quoted with advantage.

During the malarious period of the hot weather and the monsoon, some 2,000 troops are sent from the plains to Ranikhet. They are sent by train to Kathgodam and used to march fifty miles to Ranikhet by a road of which, at least, one-third was in the malarious lower hill areas, with three camps actually in these areas. It was found that a large number of men, who had been sent to the hills for cold storage, undoubtedly were being infected during this period of transfer. One of us worked out the relative costs and showed that, even taking only cases definitely infected during the journey, the cost of this malaria plus the cost of the upkeep of the camps would justify the introduction of motor transport and might actually give a saving. The result was that motor transport for the whole of the troops on this route was sanctioned, and a most satisfactory reduction of malaria from this source was obtained. Incidentally, we might remark that Colonel Fry, who was then the A.D.M.S., when first approached with this project remarked, " Yes, very good, but don't expect me to believe any of your figures."

However, we obtained our object.

A few months later the Controller of Military Accounts met one of us and said, " Oh, you are the fellow who has cost the district 72,000 rupees." We think that he held a biased view.

If we consider our average cantonment in relation to this question of relative cost, it would appear that in many cases mass protection will be the most effective and the cheapest in the long run. But we must be prepared to augment this by other obvious measures, and be prepared to show that the initial outlay will give a final reduction of the incidence and cost of malaria.

(*To be continued.*)

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Editorial.

DIET AND THE TEETH.

In 1890, Miller formulated the theory that dental caries is mainly dependent on the acid produced from the fermentation of carbohydrates in the mouth, and that consequently the prevention of dental disease is largely a matter of oral hygiene.

But conditions external to the teeth resulting from the fermentation of food are inadequate to explain why certain persons have perfect teeth in spite of total neglect of oral hygiene, while others who take the greatest care in cleansing their teeth suffer extensively from dental caries.

It had been known for many years that the development and arrangement of the teeth are influenced by constitutional conditions, but it was not realized until Mrs. Mellanby made her investigations that the minute structure of the teeth and the development of dental caries were dependent on the kind of food taken and absorbed.

Mrs. Mellanby's work originated in certain observations made during her husband's research on rickets, when it was noticed that there was great variation in the character of the teeth of the puppies used in the investigation and that there was a relation between dental defects and the calcification of the bones. These facts suggested the possibility of discovering conditions which are favourable to the development of perfect teeth and periodontal tissues.

The complete story of her investigations is being published by the Medical Research Council, and will appear in three parts. The first part published deals with dental structure in dogs. Dogs have been used for the investigation of dental defects because they will eat almost any kind of food, can be kept under the same conditions as man and remain in excellent health under laboratory conditions. Though it is not easy to produce dental disease in dogs, the defects found in them under experimental conditions are on the whole similar to those found in man and periodontal disease is common.

In an early stage of the investigations great, and in general constant, differences in the development of the teeth were observed according to the kind of fat in the diet. Cod-liver oil was found to exert the most powerful calcifying influence on teeth. Beef suet and butter also improved calcification, but bacon fat appeared to have little effect. No correspondence was found between the physical and chemical properties of the various fats and their influence on calcification. Mrs. Mellanby at that time thought the calcification to be dependent on the presence in the diet of a vitamin of similar distribution and properties to the fat-soluble growth-promoting vitamin A, described by McCollum and Davis. But the distribution of this vitamin and that of the calcifying substance did not exactly correspond and later work showed that vitamin D and not vitamin A, was concerned in the calcification process. When the experiments were made the growth-

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promoting power of vitamin D had not been described and, as it is associated in many foods with vitamin A, it was not unnatural to suppose that this vitamin was the important factor.

The administration of milk resulted in good calcification and even separated milk appeared to have a beneficial effect, but not to the same extent as whole milk. Some of the improvement in calcification caused by separated milk was found to be due to its large calcium content.

Egg yolk caused perfect calcification on a diet containing white bread, and only slightly defective calcification with oatmeal, which as experiments to be related later indicate, contains a potent anti-calcifying factor.

Cabbage has some power to promote calcification, but is variable in its action. The action is more prominent with white flour than with oatmeal.

Experiments were then made to determine the effects of foods rich in protein. Meat is supposed to have a beneficial effect on the teeth, largely based on the idea that the biggest meat-eating races have good teeth. Since meat is generally associated with fat, which has been shown to stimulate the calcification of teeth, it was necessary to remove all visible fat before adding meat to the diet. But even then there remained small particles of fat between the muscle fibres. Meat extractives from which all fat had been removed had no effect, so the improvement in calcification noted with "lean" meat was considered to be due to the retained fat and its associated vitamin.

Egg albumen and milk proteins, caseinogens, were found to have no effect on calcification. Many experiments with cereals having a high carbohydrate content were made, but no beneficial effect on calcification was noticed. Zilva and Wells, who fed guinea-pigs on a scorbutic diet, found various degrees of degeneration in the pulp and an irregular osteoid condition of the dentine of the teeth, but these changes did not occur when vitamin C was added to the diet. These teeth lesions are rarely found in man, and though it is improbable that the actual structure of the teeth is influenced by a deficient intake of vitamin C, the spongy gums associated with scurvy suggest that this vitamin plays a part in some dental diseases. Whether fat-soluble vitamins were present or not, vitamin C appeared to have no effect on calcification in the teeth of puppies.

The anti-neuritic vitamin, B_1, and the anti-pellagra vitamin, B_2, do not assist calcification; a diet rich in these vitamins results in poorly calcified teeth unless fat-soluble vitamin is present as well.

We have already referred to Mrs. Mellanby's idea that the good results obtained in her early experiments were due to a fat-soluble vitamin, probably A, but in 1920 and 1921 she had considerable doubts as to whether A was the really effective vitamin, as a study of its distribution showed considerable differences in the behaviour of certain foods as stimulators of growth and stimulators of calcification. Rosenheim in 1925, and Wilson in 1927, showed that mammalian liver is very rich in vitamin A. Liver

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fat is richer in this respect than cod-liver oil, but the amount of calcifying activity from this fat is very small. Zucker showed that alcoholic extraction of cod-liver oil removed the calcifying vitamin, but left vitamin A in the oil; vitamin A is also more rapidly destroyed by heat and oxygenation than the calcifying vitamin.

The early experiments to determine the presence of vitamin A by means of its growth-producing properties were complicated by the fact that vitamin D has more power to promote growth than vitamin A, and the calcifying effects attributed to A were really due to vitamin D. It is practically certain now that vitamin A does not play a significant part in calcification.

Some interesting experiments were then made on the effect of combining the calcifying fat-soluble vitamin D with cereals in the diet. It was found that when this vitamin was in small amount in the diet, increasing the cereal promoted growth, but caused poor calcification. This result appeared to be due partly to the increased rate of growth, and partly to some anti-calcifying substance in the cereal.

In all the experiments in which vitamin D was deficient in the diet the animals receiving oatmeal had the worst teeth of the series, while the teeth of the animals receiving white flour or rice, though defective, were the best of the series. When wheat germ was added to white flour or rice the teeth were still more defective.

Mrs. Mellanby uses the term "anti-calcifying" to describe the effect of cereals on the teeth and the term indicates that the cereals definitely interfere with the laying down of calcium salts in the developing teeth. Attempts were then made to find out if the anti-calcifying factors were associated with any of the normal constituents of the cereal—the protein, fat or carbohydrate. Oatmeal and wheat germ which have marked anti-calcifying effect contain far more fat than any of the other cereals and it was thought the factor might be associated with the fat. But the results showed that in all the cereals tested the anti-calcifying factor remained in the residue after the fat had been extracted. As neither the protein nor the carbohydrate could be incriminated, attention was directed to the mineral elements, especially calcium and phosphorus.

McCollum showed that abnormal phosphorus-calcium ratios were of the first importance in the production of rickets in rats and it seemed possible that the effect of the cereals might be explained by the relative amounts of these elements in each cereal. Oatmeal has the relatively high calcium-phosphorus ratio of 1-5·7 and it was thought that cereals having a high ratio would show an interfering action on calcification, while others, with a low ratio would give better calcification. Unfortunately for this conception, white flour has a higher calcium-phosphorus ratio than oatmeal which gives the worst results. Although it cannot be said that the anti-calcifying factor does not contain phosphorus the evidence is definitely against the absolute or relative amounts of calcium and phosphorus being implicated.

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The influence of chemical manipulation on cereal action was then studied. Heating oatmeal to 120° C. does not destroy the anti-calcifying factor, but boiling it with weak acid appears to remove its anti-calcifying influence.

Mrs. Mellanby regards the anti-calcifying factor as specific, and E. Mellanby has given it the provisional name of toxamin.

On account of the high proportion of calcium and phosphorus contained in the tissues of the jaws and teeth it was natural to assume that factors influencing the intake and metabolism of these elements might be of special importance in the development of the jaws and teeth. Rose stated that the most beautiful teeth were found in those German provinces which had a hard water. Though this may be a factor in the building up of good or bad teeth the Mellanbys' experiments prove that it is not an essential one. E. Mellanby showed that vitamin D has a great importance in the calcification of bone, and there seems no doubt that when a diet contains little vitamin D the amount and ratio of calcium and phosphorus ingested bears some relation to the ultimate calcification of the bones.

When a diet is greatly deficient in vitamin D and especially when oatmeal forms the greater bulk of it, the addition of calcium brings about definite improvement in the formation of the teeth, which are, however, still defective.

When vitamin D is in moderate amount the addition of calcium causes the most beneficial effect, but is insufficient alone to produce good calcification.

When there is a large amount of vitamin D in the diet, good calcification results even when the quantity of calcium present is very small, whether oatmeal or white flour is the cereal eaten. There appears to be no such thing as a "minimum" or "optimum" of calcium to obtain perfect calcification. Within wide limits a large amount of vitamin D and a small quantity of calcium will produce better teeth than a large amount of calcium and little vitamin.

The effect of environmental conditions on the development of the teeth is of considerable interest. Exercise in the open air is of far less importance in the development of perfect teeth than a suitable diet. If the diet contains plenty of fat-soluble vitamin D dogs may be kept in confinement and yet develop perfect teeth; under the best hygienic conditions and with plenty of exercise the teeth will be badly formed if vitamin D is deficient in the diet. While exercise alone of the whole body has comparatively little effect on the development of the teeth, dental surgeons have believed that movement of the jaws during mastication of hard substances by improving the local circulation, has an influence on the growth of the jaw and the development of the teeth. Mrs. Mellanby's experiments do not afford any satisfactory evidence for this belief. She found that dietetic conditions which produce good calcification stimulate muscular activity and give the animal the desire to exercise the jaw muscles to the maximum extent.

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Sunshine improves calcification of the teeth and the explanation of this result became evident in 1927 when Webster and Windaus and Hess proved that ergosterol was made into vitamin D by ultra-violet radiations and that ergosterol was present in the skin. These results threw a flood of light on Mrs. Mellanby's experiments on the effects of sunshine made in 1924.

In her later work she found that fats such as olive oil, which has no calcifying influence and butter which has some calcifying effect, develop on irradiation a powerful action producing good teeth. Cereals, even oatmeal and germ of wheat, when irradiated cease to have an anti-calcifying effect on the teeth and become calcifying in their action. This effect is due to action of the rays on the fat constituent of the cereal and the probable formation of vitamin D, and not to the destruction of the anti-calcifying factor.

Ante-natal and post-natal feeding have an influence on the development of deciduous teeth of puppies. Mrs. Mellanby points out that at the time of weaning, five to six weeks after birth, all the teeth are fully erupted and the crowns calcified. Their structure, therefore depends on the supply of the necessary material by the mother during pregnancy through the placental circulation and during lactation through the milk. As the deciduous teeth of children are not completed until they are 2 to 3 years old, their structure is not so dependent on the maternal supply and is largely influenced by the feeding between weaning and the complete eruption of the teeth.

In 1920 and the following years Mrs. Mellanby demonstrated the effects produced in the offspring by the feeding of pregnant and lactating mothers on diets deficient in fat-soluble vitamins and discussed the sacrifice of essential substances made by the maternal organism to the developing fœtus. It was then suggested that the liability of pregnant women to caries was probably caused by the giving up of vitamin D from the maternal tissues to the offspring. Mrs. Mellanby's experiments indicate clearly that when the mother is fed on a diet deficient in vitamin D and rich in anti-calcifying factors the deciduous teeth show defects in structure and their eruption is delayed. When, however, the diet is rich in vitamin D the teeth are well calcified and erupt early.

Similar results are seen in the permanent teeth when the mother's diet is deficient in vitamin D. The offspring have poorly calcified teeth, defects appear earlier and eruption is delayed.

These observations are of great importance in view of the diet of so many of the poorer classes being largely made up of cereals and deficient in substances containing the specific vitamin.

We look forward with great interest to the publication of Parts II and III of Mrs. Mellanby's work, which deal with the development of dental disease in animals other than dogs, and the part played by diet in the development and resistance to disease of teeth in the human subject.

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Clinical and other Notes.

THE BIRD BOX VENTILATOR FOR VENTILATING VEHICLES.

By Major W. BIRD,
Royal Army Medical Corps.

This invention supplies a long felt need for the ventilation of our public and private vehicles.

It provides a simply constructed ventilator which will extract foul air from vehicles without causing draughts, while at the same time it prevents the ingress of rain, snow and sleet. It is simply made, and every part is accessible for cleaning.

It is merely a box divided diagonally but not quite completely, with a hole in the bottom, placed flat on the top of the vehicle over an opening in the roof. A horizontal funnel is thus formed in front, with the mouth forward, as shown in figs. 1 and 2. When the vehicle is in motion the air flowing into and through the mouth of the funnel will be forced through the narrow opening at its rear end, causing a suction between the narrow opening of the funnel and the roof of the vehicle, thereby extracting the foul air through the opening of the roof.

In more detail, the ventilator is a box 7¼ by 6 by 2¼ inches, divided almost completely by a diagonal plate extending from the anterior lower edge to 2 inches short of the posterior upper edge, where it is free along the whole of its posterior border, forming a slit-like opening ¼-inch wide. In the centre of the floor of the box is a circular opening of 2 inches diameter, having its edges raised into the interior of the box to prevent the ingress of rain, sleet and snow. This opening passes through and is clamped firmly to the roof of the vehicle. The opening may be provided with a circular diaphragm as used in cameras and microscopes to narrow or close the ventilator from the periphery if and when desired. The internal surfaces should be glazed or enamelled.

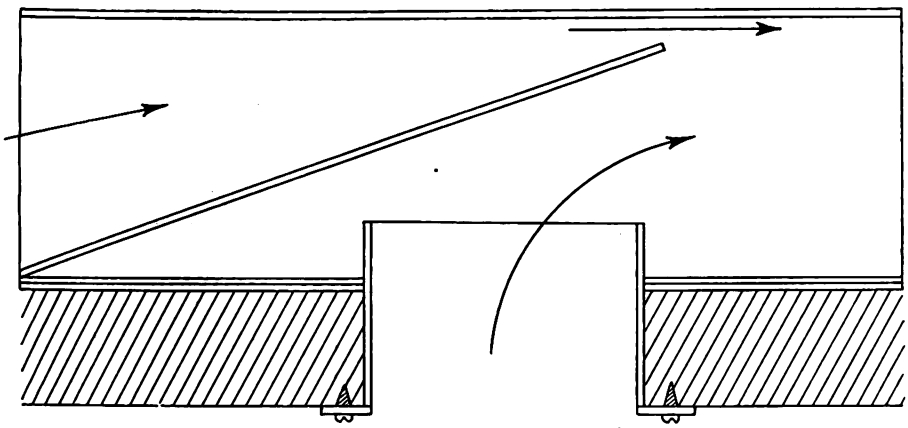
The interior lighting of the vehicle is conveniently arranged immediately below the opening. The heat generated from the light in this position also assists the ventilation. In double-decker 'buses the ventilator is conveniently placed on the sides of the vehicles, so that the opening lies at the level of the roof. In this case the internal lighting is placed just under the opening.

A suitable inlet in the floor of the vehicle allows air which has been warmed by the exhaust gases to pass into the vehicle which, besides warming the interior, will cause convection currents to aid ventilation. For this purpose a grid is fitted into the floor of the vehicle over the length of the exhaust pipe, which itself is enclosed in a tube of U-section, the open end of the U being closed by the grid. This tube has a funnel-shaped opening at the front facing the front of the vehicle, with the wide end of the

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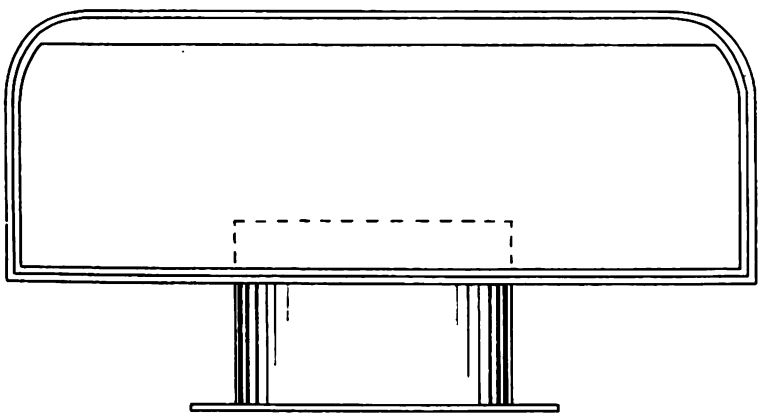
funnel adjustable so that it can be enlarged, narrowed or closed at will to regulate the amount of air intake to the amount extracted, so that the ideal of air movement without draught is attained. Means are thus provided for passing the air heated by the exhaust pipe through the grid into the vehicle. The intake air may be conveniently and simply filtered and moistened if necessary.

FIG. 1.



Cross Section Side View.

FIG. 2.



Front View.

Patent pending No. 33774/29.

Most ventilators at present in use on 'buses and trains serve as both inlets and exits for air. They are so constructed that some of the air forced in through the front part of the ventilator in the roof by the wind pressure caused by the motion forwards of the vehicle must be immediately extracted by the rear part of the ventilator acting as an extraction ventilator. These ventilators are complicated by many parts and awkward angles, and

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cannot be easily cleaned out, and so air may be contaminated by dirt and dust.

The only air inlets in many vehicles are found to be the windows, or inlets placed above the windows near the roof. This is obviously wrong in principle, as cold air inlets should either be in the floor, at floor level, or appreciably lower than the warm air exits, otherwise the lower parts of the vehicle are not ventilated.

The majority of 'buses, even at the present time, have made no provision for ventilation except the windows and doors, which during cold and wet weather the passengers insist on keeping closed. Even those who are prepared to stand a draught are forced during rain to close the window or get wet. In the new ventilator none of these differences in fresh air hunger are allowed to exist. Each individual is given as much fresh warmed, filtered and moistened air as possible. In a full 'bus the amount of air space per passenger is extremely small, especially when the 'bus is allowed to be overcrowded, as it frequently is. If the 'bus is not properly ventilated the heat becomes uncomfortable. Most of the passengers have come into the 'bus from a cold exterior heavily clothed with overcoats which they have no opportunity of removing. Their wet outer clothing adds to the humidity of the atmosphere. Their discomfort in the 'bus is intolerable; they break out into a hot sweat, and are intimately in contact with passengers suffering from colds and influenza, and on alighting from the 'bus they are met by the cold wet blast of our insular climate. A more favourable opportunity for *Micrococcus catarrhalis* and his numerous friends and relations never existed. Thus throughout our winters the spread of colds and influenza is assisted.

At the present day more people than ever are travelling, and more than ever are travelling by 'bus. What would be more comfortable for our London to Edinburgh "sleeper" 'bus than the ideal of air movement without draught? It is pleasant to feel that as we touch the coast we are benefiting by a brief spell of warmed ozone, and as we top the mountain we are for a few moments gaining the benefits of a high altitude instead of rebreathing Mrs. Valentine's exhalations and the aroma of Mr. Snooke's bad cigar.

The transient exposure to carbon monoxide poisoning from the exhaust gases is a real danger in badly ventilated vehicles. That the danger must be real is indicated by the fact that scientific inquiries have been made and exact experiments have been carried out in this country and America on the danger of carbon monoxide fumes from the exhaust pipes of motor vehicles in the streets and garages of great cities *outside in the wide open air*, and yet we are supposed to be immune when the gases are pumped into our 'buses and saloon cars. I have actually seen a 'bus with the exhaust pipe ending about the centre of the wooden floor of the 'bus to prevent the passengers from breathing the gases as they enter the door from the back of the vehicle. Some persons are more susceptible to small

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doses of carbon monoxide than others, and these are the persons who suffer from headaches after travelling in badly ventilated 'buses and saloon cars.

Our enterprising Morris in his new cars collects fumes from the crank case and prevents them from entering the body of the car, showing that the danger is not only apparent, but real. This is a step in the right direction, but ventilate the car in addition.

Most of us have experienced how frequently moisture from the breath of the occupants of a saloon car collects on the interior of the windows and makes visibility for driving difficult, especially on a cold, rainy day, and one has to be continually wiping off the moisture from the glass screen to see to drive. Efficient ventilation does away with this difficulty, as is seen when the windows are again opened.

Both in the services and in civil life it is of the first importance to ventilate and warm our ambulances. Accident cases require warmth to combat shock, and the ordinary cases of sickness usually come from a warmed room and dread "catching cold" in the ambulance on their way to the hospital. Usually all windows and openings are tightly closed, sacrificing ventilation to gain warmth.

This box ventilator is especially designed to meet the need of warming and ventilating our ambulances in the Services.

The same apparatus may be applied to the tops of chimneys, provided a wind vane is placed on the top of the box ventilator to ensure that the wide end of the funnel always faces the wind, and an arrangement is made whereby the whole apparatus may circle round on the top of the chimney opening. In this case the circular opening in the floor of the box corresponds in size to, and fits over, the top of the chimney opening. During windy weather this apparatus ensures a strong extraction of the smoke, and assists in the ventilation of the room below. The dimensions of the apparatus of course require to be about double those described above.

MEDICAL HISTORY SHEETS.

A Suggestion for Further Co-operation in the State Medical Services, with Special Reference to the Civil Population and the Combatant and Other Forces.

By F. S. HILL,

Late Staff-Sergeant, Royal Army Medical Corps.

Although the various branches of the Public Medical Services developed rapidly during the latter part of the last century, little attempt has been made to co-ordinate those sections that deal with civilians and with combatants. For example, the "Medical History" of a recruit begins with his examination on enlistment, and terminates upon his leaving or being

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"boarded out" of the Service. But no organization exists whereby his "history," prior to enlistment, is rendered available, nor is his medical record available for any authority or insurance subsequent to his resignation from the Service; although it is fairly obvious that all these periods might, with advantage, be linked together.

What is true of such lack of co-operation when the middle period concerns a combatant (or ancillary) force such as the Army, is equally true of the Police Force, or, for that matter, when any section of the activities of the State or any Municipality is concerned—the principle involved being the same, namely, continuity of medical records.

In view of the enlistment of many women as W.A.A.C.s, W.R.E.N.s, W.R.A.F.s, and nurses in the Services, etc., some such scheme could equally be formulated for them.

The first record which is kept by officers of local authorities relating to the health of individuals, is under the Maternity and Child Welfare Act, 1918, and though principally medical in nature, it contains other information, some of which is of sufficient importance to justify its retention. With the re-organization of the work of local authorities consequent upon the passing of the Local Government Act, 1929, doubtless in those few districts where this practice has not been instituted, these records will in future be passed on to the education section when the child enters school, and be augmented by the School Medical Service in the case of elementary schools. In the case of those children so happily placed that no advantage need be taken of facilities under the Act their medical history will probably commence with their entry into one of the public schools; but for the major portion of the community the School Medical Service now prepares a dossier for every child, which contains a complete record of its medical history, results of medical inspections or special examinations, treatment given at special clinics, operations performed, transference to special schools such as open-air, mentally or physically defective, and so on. In very many cases by the time the child leaves school, a valuable clinical record has been compiled, and it is unfortunate that no further use is made of this in connection with the child's subsequent life. When the child leaves school the dossier is filed away for a certain period of time, but is not passed on to any other authority.

So far as the combatant and allied Services are concerned, in times of peace it should be possible for some system to operate whereby recruits could be tentatively accepted pending the receipt of these dossiers, or confidential extracts from them. While such information was being obtained, inquiries could be instituted into the personal character of the recruits—this is especially desirable, for example, in the case of the Police Force. In times of stress, when recruits are being enlisted at a very rapid rate, such enlistments might be made with the proviso that defects not revealed or ascertainable at the medical examination but discovered from earlier records, should, if the circumstances justified such a course, be

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taken into consideration if the person concerned was found on discharge to be in some degree unfit and claimed a disability pension.

In order to make any such system reasonably complete, it would be necessary for some method to be inaugurated whereby a person's "Papers" would be called for whenever certain medical treatment was accorded in civil life, and returned to a recognized "Records Authority" upon completion of such treatment. Thus, for example, should the Army ask for the medical papers of a would-be recruit who, since leaving school, had received treatment at a tuberculosis dispensary or county sanatorium, the fact that these latter institutions had on his admission obtained the man's "Papers" from the school authority and had forwarded them to the Medical Officer of Health of the district to which the patient was discharged when treatment was completed, would prevent incomplete records being supplied to the Army Medical Authorities. In passing, it may be observed that the previous history of youths undergoing training at Borstal institutions would be of great value to the medical staff. For example, the knowledge that such a person had in earlier years suffered from encephalitis lethargica would be of great value to a medical officer in charge of such an institution.

Pursuing this principle, it should be possible for the examining medical officer of a Government department or local authority, before passing as fit for employment under their authority and admittance into a superannuation or provident scheme, to obtain, in the case of ex-Service men, from the Army a confidential statement of such a person's "medical history," or in other cases from the appropriate officer of another authority the record of the applicant's health, etc., in previous years.

The benefits of some such arrangements are clear, and they would prevent anomalous conditions arising. The great value to a medical officer of a soldier's medical history sheet and case papers, when the man is admitted to hospital, demonstrates the benefit that would be derived from a more complete record; heart trouble would be appreciated in its connection with rheumatic fever in childhood, affections of the respiratory organs could be considered in relation to attendance at a tuberculosis dispensary in earlier years as a "contact" of a consumptive relation, and so on.

The whole question affects many aspects of the organization of society, the civilian and the combatant, the child and the criminal, the driver of an armoured car and the driver of a fire engine; for all sorts and conditions of men are more and more coming under medical supervision, and the tendency for medical fitness to be a *sine qua non* of employment renders it desirable that some attempt should be made at further correlation of the results of medical examination and treatment, in order that when a medical officer serving the State, either nationally or locally, is called upon to give an opinion as to a person's mental or physical fitness, he shall be in possession of all available previous medical knowledge concerning the individual.

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Echoes of the Past.

HONG KONG.

A Collection of Fragments, Literary, Statistical and Historical, with Special Reference to 1845 and 1865.

By Major W. K. MORRISON, D.S.O.
Royal Army Medical Corps.

Nothing original is claimed for the following article. For the most part, literal extracts are given and so the reader must be careful, before condemning the ponderous "English," to be certain that such was not written eighty years ago.

A sojourn amongst these dusty volumes of the past was transposed into the vivid present at Happy Valley, Hong Kong, on a Saturday, in October, 1929, when the black imprint of a tombstone stood out clear in the rays of the setting sun:—

ALEXANDER MACINTYRE ESQ. M.D.
Assistant Surgeon 2nd 11th Regiment
DIED 5TH SEPTEMBER 1865.

"If any unfortunate individual in either of Her Majesty's Services be compelled by duty, to come to Hong Kong, just let him have a stout heart and a lively faith in God's Mercy, which latter may spare him to curse the place, should he escape fevers and typhoons, he may say and think to himself that verily Providence has watched over him. The Island of Hong Kong is not only the most unhealthy spot in China, sparing neither age or sex, but the site selected for Victoria, the principal town and seat of Government, is the most unhealthy locality in the whole island.

"The cheerful note of a bird is never heard in Hong Kong. The only living creatures which appear to defy the climate are the vermin. No part of Hong Kong can ever be salubrious. The most efficient engineers or the most scientific men cannot render malaria wholesome or conducive to longevity. The strong man and the weak, the sober man and the drunkard, the man who never exposed himself to the sun, he, who defied it—all died alike.

"The island contributes but little to the support of its inhabitants, if we except the quantity of manure, which is returned to Cowloon and enables the cultivator there to rear fruit and vegetables for the consumption of the population of Hong Kong.

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"Hong Kong is an unhealthy, pestilential, unprofitable and barren rock. The harbour is nearly four miles in length and rather more than one and three-quarters in breadth. There ride at anchor many of the wooden walls of Old England, manned by brave hearts of oak. Some individuals, attracted by the beauty of Happy Valley, erected some desirable residences there. Alas! Sickness and death lurk amid this picturesque scenery, for the exhalations arising from the water produce fever and ague, which too frequently terminate fatally. The successive inhabitants of each of these residences were seized with fever and died. The goodly dwellings are now all deserted and falling into decay. The doors and venetian blinds are dropping off their hinges. Rank weeds spring up in what were once flower beds.

"Where are they now??? Tenants of the cold grave—their earthly remains being devoured by the disgusting land-crab." (September 28, 1848, H. C. SIRR, "China and the Chinese.")

The new arrival in Hong Kong has not long to wait before he is informed of Stanley—Stanley with its well-filled graveyard and its paucity of tombstones.

But though Stanley took its toll of the soldiers, and the women and the children, yet in the early days of Hong Kong there was no place in the neighbourhood which did not do likewise.

In those times a few wretched huts, built on shelves cut out on an acclivity of a ridge at the West Point, were called barracks, but were really pest-houses; and after causing the death of many a gallant soldier of the 55th Regiment (2nd Battalion the Border Regiment) were abandoned and razed to the ground.

The regiment was put on board ship in the harbour on August 16, 1843. The diseases, which affected them most, were periodic fever and dysentery. "Dysentery, which with malignant intent, seldom gave up its victim."

One can imagine that the latter would spread more rapidly on board ship than on shore. In the convict ship, "The Royal Saxon," which in later years lay off Stonecutters' Island, dysentery was a common cause of death.

The removal of the 55th to the ship in the harbour did not make up for the lack of good barracks.

"Every morning and every evening funeral boats could be seen leaving the ship's side." This remedy was to fail again in 1848.

The need for barracks in the early days of the Colony was met by the construction of Stanley Barracks, at Check-Choo (now Stanley) on the south side of the Island. The site was specially selected for its position facing the south-west monsoon. The barracks were begun in January, 1843, and completed in December of the same year.

In 1844 they were occupied by the headquarter station of the 98th (the North Staffordshire) Regiment. The remainder of the regiment was stationed at Victoria, where it is interesting to note that one officer had

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the pleasure of waking up in the middle of the night to find a robber in his room, and stuck his sword through him! It is recorded of other robbers, how, on one occasion, an officer about to depart for the United Kingdom packed all his boxes and trunks, and interlacing them with an iron chain, one end of which he wound round his wrist, fell off into a happy and peaceful slumber. When he woke up, he perceived a peculiar aroma in the room, found his boxes all gone, and a large hole in the wall the only indication of their exit!

Stanley was occupied in full until 1861, its worst year being 1858. After 1861 it was used for a few years for small parties and for the wives and children of regiments on service up North. It is mentioned finally in 1874, being still used by the artillery during their annual gun practice, when, in the course of the night of September 22-23 of that year, a short but fierce typhoon demolished the buildings and levelled the walls to the ground. The buildings, however, had long been in a ruinous condition from the ravages of white ants. Stanley, as already mentioned, is the first name heard by new arrivals in connection with the old military history of Hong Kong on account of its toll of disease and death. Yet, in his evidence before the Parliamentary Committee on the Mortality of Troops in China, the barrack-master stated that Colonel Caine, the Lieutenant-Governor, used to "book" rooms there every hot weather because it was so healthy. "He should have known," says the barrack-master, "because he had resided in Hong Kong for twenty-two years."

The journey to Stanley is accomplished nowadays by motor car along a most excellent motor road, but even in 1864 it was a dangerous place to go to on account of land-robbers. No Chinese contractor could be found willing to undertake the daily supply of meat to the small detachment there. The meat was carried by the Chinese coolies under escort of one non-commissioned officer and three men. On one occasion an officer went with them, and as he was strolling on in front he was suddenly set upon by robbers, who, however, took to their heels directly he drew his revolver. The land journey was not safe, but neither was the route by sea. One day a large sum of money was sent round by boat. The guard consisted of one non-commissioned officer and six men. When they reached the south side of the island, a large sampan, clumsily steered, fouled their own boat. After a brief moment, the only survivor, the non-commissioned officer, was swimming, wounded, to the shore.

The diseases which made Stanley so unhealthy were paroxysmal fevers and bowel complaints, the former predisposing to the latter. That bowel complaints are prevalent in China, and have been so from time immemorial, is not to be wondered at, when one considers that their main fertilizing agent for the soil is human ordure. But it was left to the cynic to define China as a country where one half of the inhabitants had diarrhœa, while the other half spent all their time in its transportation.

There is a sad picture of Stanley given by Dr. Snell, Surgeon of the 99th (The Wiltshire) Regiment, in his evidence:—

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"About the beginning of August, 1864, I went to Stanley to inquire into the exceedingly sickly state of the women and children of the 20th Regiment (The Lancashire Fusiliers) there. The exceedingly wasted, sickly and worn-out appearance of the women, most of them suckling infants, led me to the belief that they were not receiving a sufficiently nutritive diet. I therefore recommended that each woman should receive two-thirds of a pint of porter with her rations, and that each child should have half a pint of fresh milk daily. I gave this in writing to the Commandant, and beyond that I know nothing, except that the milk had to come as a matter of charity by subscriptions from the officers and civilians. I know the issue had a highly beneficial effect upon their health. I made the issue under the existing Sanitary Regulations.

"On February 21 I received a letter in London calling upon me to pay £15 15s. 4d. 'for this very irregular issue into the hands of the general agent who has been instructed accordingly.' I replied I had not ordered it; I had recommended it, and that I should have been wanting in common humanity and departing from the ordinary principles of my profession if I had neglected to make the recommendation. The women and children were suffering from fever and other forms of miasmatic diseases and the rate of mortality was very high."

On March 20, 1866, it was announced in the House of Commons that a Select Committee would inquire into the mortality of the troops in China.

Dr. Snell continues: "I received a letter on March 18, 1866, stating that, in view of the special circumstances of the case, the claim made upon you for the value of the issues has been remitted."

Stanley, then, were the first barracks to be occupied by British troops in Hong Kong. In 1844 the North Barracks, on the north side of Queen's Road were occupied, and the buildings still stand in the Royal Naval Dockyard to the west of the main entrance.

On the other side of the Queen's Road, a little further to the west, Murray Barracks were begun in 1844 and occupied on January 8, 1846, by a detachment of the 18th (The Royal Irish) Regiment.

Is it any wonder, therefore, that the Colonial Surgeon, in his report for 1848, should state, "The health of the soldiers has been remarkable, and is ascribed to the magnificent construction of the barracks and hospital, which will remain a lasting monument to the ability, liberality and efficiency of the military government of Major-General D'Aguilar and his staff."

The same General D'Aguilar, whose name is still borne by landmarks in Hong Kong, acquired a definite notoriety by his zeal in putting down the disturbing noises of the night. He could not sleep, so it is alleged, for the noise of the night-watchmen striking their bamboo gongs on their rounds; it did not take long to remove the gongs from the night-watchmen. But once again, his sleep was disturbed by the quacking of ducks or geese, the property of a neighbour; it did not take long to remove the heads of

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the offending poultry. His interest in putting down the piracies in the vicinity of the island was at a low ebb, so it is said, until one fine day his two sons returned literally in sackcloth (but no ashes), having been pirated on board a schooner *en route* to Macao!

But the statement of the Colonial Surgeon is curiously contradicted by one writer who states: "The mortality which has prevailed among our troops, from the first landing in Hong Kong in 1840, up to this time, the end of 1848, will fully bear out the assertion that the summer in China is far hotter and more fatally injurious to the constitution than the hot months in India; in despite of commodious barracks and hospitals, our poor fellows fall victims to the pestilential climate of Hong Kong in a fearful manner. The winter from November, 1847, to April, 1848, was a very mild one. The south-west monsoon set in early; the periodical rains fell late. June came, and with it came the fever. By the merchants, who were turning bars of opium into bars of silver, it was said that a little sickness might be expected. Nevertheless, June went on, and brought with it the end of July without any improvement; and it was found that H.M. 95th Regiment (The Sherwood Foresters) had buried 47 men, and had as many as 299 sick out of 450. Then came August, and death was still walking about, and men began to conjecture where it was going to end. August, however, came to its close, and the 95th Regiment buried 47 more men, and the Corps were put into hired vessels anchored in the harbour of Victoria to save those who remained. September set in and brought hope with it; but hope came, though it was false, for death had not been satisfied, and they continued to fall victims. And now that the month draws to its end, the living hug the idea that the winter is coming on, and that it will set up their constitutions. Time will prove how far they will have reason to congratulate themselves. The expense of putting the Corps afloat has been nearly £2,000. Without calculating that every soldier, as he stands on this accursed soil, costs the country £130, and that, therefore, the 95th Regiment alone, have laid under its fruitless and cheerless earth—to say nothing on the score of humanity—about £14,000 worth of men in three months."

Confirmation is afforded by a visit to the cemetery at Happy Valley, where a tombstone reads thus:—

"H.M. 95th Regiment, 1st June to 30th September, 1848, 'died of fever,' 88 soldiers and 8 women and children; 'died of other causes,' 171 soldiers and 21 women and children. Total deaths, 288."

Contradictions are to be expected, and the writer of the tragic description of the plight of the 95th Regiment makes a statement in his work, that he cannot understand why Hong Kong should be taken for a Colony, whilst Chusan,[1] which is both productive and salubrious, should be

[1] The principal island of a group situated off the eastern coast of China in latitude 30° N. and longitude 122° E.

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abandoned. Yet elsewhere it is recorded that Chusan is the "Walcheren" of these regions, and an equally tragic description is given of the 26th Regiment, the Cameronians (Scottish Rifles). Four hundred men of this regiment are depicted lying on the floor of a "pawnshop" in Tinghae Chusan "stretched pale and emaciated. On many a morning three to seven victims were carried out to be buried on a hill, where they had recently been encamped."

While Dr. Macpherson in his "War in China" explains this further: "It required no gifted soothsayer to prognosticate what the results would be, where men were placed in tents, pitched in paddy fields, surrounded by stagnant water, putrid and stinking from quantities of dead animal and vegetable matter. Under a sun hotter than that ever experienced in India, the men were buckled up to the throat in their full dress coatees. Bad provisions, low spirits, and despondency drove them to drink."

But in Hong Kong, the provision of excellent barrack and hospital accommodation, did not prove the remedy for the Hong Kong fever nor for the bowel complaints.

Hong Kong fever is described in several of the books of the day, and the name would appear at times to include fevers that were other than malaria. The malarial fevers were the predominant type, as exampled by the fact that Sai Wan Barracks (near Lyemun) were vacated because of "ague" on January 9, 1846. The troops concerned were a draft of the 98th Regiment. Dr. Kinnis, then P.M.O., writes, "Sai Wan is bounded by lower hills which are cut into terraces, rising behind each other for the cultivation of rice. The rice fields are fed by streams, from between the hills, which fall into the bay and the water remains stagnant during the ebb-tide, and doubtless contributes to the remarkable prevalence of ague at this station."

One writer gives the following description: "A new symptom has developed itself in this disease, namely, that of an eruption resembling the smallpox, accompanying the fever and our most skilful medical officers are baffled in their endeavours to save the victims. The temperate and the intemperate become victims alike of this dreadful fever, which commences with a slight headache, gradually increasing until the whole head is so tender that no part can even bear the pressure of the pillow without agony. The eyeballs are in such extreme pain, that light can be ill-endured, yet the suffering produced by the closing of the eyelids is intolerable. The symptoms increase hourly and the patient sinks under its violence about the third or fifth day. Hong Kong fever has these peculiar features, that the patient will, apparently, become much better and rally considerably a short time before death. Instances have constantly occurred of the sufferer sitting up in bed or rising from it, when suddenly delirium would become manifest and the patient die from exhaustion. In other cases the patient, after rallying, will be seized with frightful convulsions and after many hours of painful suffering (distressing in the greatest degree to the medical

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attendant, because his knowledge is insufficient to alleviate the agony he witnesses or save the life of the patient), the stricken being will cease to breathe. Medical men admit that medicine is of little service in this fever. All that can be done is to apply cooling lotions to the head; aperients, febrifuges should be administered. Local bleeding is adopted by the application of leeches to the head. During the recovery great danger arises from the extreme debility and dysentery which invariably follow. The febrile attacks frequently return."

The Colonial Surgeon in his report for 1865 describes a fever thus: Victoria Gaol, "The disease exhibited itself as a bilious fever, recurring in the form of the continued, remittent or intermittent type, passing in all fatal cases into the typhoid type, frequently terminating by hæmorrhage from the bowels, and in some cases by black vomit. The skin became yellow, with an orange tinge, passing into an olive, and all the fluids of the body were a marked yellow. In fatal cases spots of ecchymosis over the body were not infrequent. As far as I could ascertain the fact, the disease proved to be contagious but not infectious, and the period of incubation was about ten days. It was undoubtedly a form of yellow fever. The disease was not limited to the town, but spread throughout the town amongst the lower classes principally. One hundred and three cases were admitted to the Civil Hospital with forty deaths. Many of the men admitted were moribund when sent to hospital. Twenty dead bodies were sent for examination in which the same epidemic had been the active agent. Very few Europeans, a small number of Indians, and no females were brought under its influence. The British ship "Tricolor" left for Dutch Guiana on May 2, when the epidemic was at its height, and had 400 coolies on board, of whom 200 died on the voyage from a similar epidemic on board. The predisposing causes of the epidemic were poverty, destitution, long drought and great heat.

Constipation, even for as long as fifteen days, preceded the fever. The disease started again in 1866 with 105 admissions and six deaths. Post-mortem examination of these cases showed intense jaundice, marked fluidity of the blood. In every case the spleen was markedly enlarged, one case twenty-eight ounces. The diaphragmatic surface of the liver was generally of a mottled appearance, sometimes coated with reddish serum. The surface of the kidneys was very vascular. The mucous membrane of the stomach near the pylorus was generally intensely congested and in many cases studded with spots of blood. The heart in one instance had several spots of blood on its surface, and in another there was a slight turgescence of the blood in the brain. The liver was much increased in size but little in weight, its substance pale and presenting numerous oil globules under the microscope. The gall bladder always contained bile of a very liquid character. There was greenish-black fluid in the stomach similar to that in the gall-bladder but more viscid. In one instance there was similar fluid in the colon, and in the same case there was about four ounces of chocolate-coloured urine in the bladder."

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Whereas the description given by Dr. Kinnis, one time Deputy Inspector General of Hospitals, is as follows : 1845 to 1846 " Remittent fever assumes a very malignant form in Hong Kong, being rapid in its course and often attended by delirium and coma. In two fatal cases in the 18th Regiment, effusion into the ventricles and increased vascularity of the membranes were found on dissection. In many cases of intermittent fever the benefit of quinine was temporary only, the primary cause remaining, the disease returned once or twice a month, wearing out the strength of the men attacked, who died from exhaustion or some super-imposed bowel complaints, complicated sometimes with disease of the spleen or mesenteric glands. Extensive and varied appearances of disease of the liver were found in examining those who had died from diarrhœa, and in one case there appeared to be a burst hepatic abscess. Acute dysentery in the form it assumes in India was comparatively rare. Chronic diarrhœa, alternating with dysenteric symptoms, prevailed in the autumn, and slowly but surely carried off its victims. Extensive ulceration of the large intestine with abscesses of the liver and swollen mesenteric glands were noted in many cases." Of other cases Dr. Kinnis reports the following : " A chronic case of rheumatism, carried off by an attack of diarrhœa, might have been more appropriately returned under 'syphilitic cachexy' : the patient's constitution was broken down, his liver diseased, and the bones of his nose and palate gone. The presence of ophthalmia at Chusan in the 18th Regiment is ascribed to exposure to currents of air during sleep, to unwholesome water for ablutions, to the inattention of Chinese barbers to cleanliness, in using only one towel for all they shave."

(To be continued.)

Current Literature.

Organization and Functioning of the Medical Service with Reconnaissance Groups of a Corps and a Division of Infantry. Méd. Lieutenant-Colonel Schickelé. *Archives de Médecine et de Pharmacie Militaires.* January, 1930.

Before 1914, in times of peace, a regiment of cavalry was attached to each Army Corps. On mobilization the headquarters and two squadrons remained with the Corps, whilst the remaining squadrons were distributed among the divisions, one squadron to a division.

Reconnaissance groups are necessitated by the profound changes imposed on the cavalry by modern fire, which is now master of the field of battle. In order to fulfil its mission a reconnaissance group must have added to its nucleus, formed by squadrons of cavalry, new powerful infantry fire formations.

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A reconnaissance group of an Army Corps consists of: Headquarters, to which the medical details are attached; two squadrons of cavalry; a squadron of machine guns; a cyclist squadron; and a platoon of machine guns on motors. It has a strength of 30 officers, 800 men, with 600 horses, 60 horse-drawn vehicles, 10 motors, 240 bicycles, and is commanded by a Colonel or Lieutenant-Colonel of cavalry. It has the fire power of an infantry battalion.

The reconnaissance group of an Infantry Division consists of: Headquarters; one squadron of cavalry; one cyclist squadron; one platoon of machine guns on motors. The strength is 15 officers, 450 cavalry men, 250 horses, 20 horse-drawn vehicles, 10 motors and 150 bicycles. It has the fire power of two companies of infantry and is commanded by a cavalry field officer (Major).

The reconnaissances groups march about twenty-four hours in advance of the columns of the Army Corps and their mission is to search for the enemy by reconnaissance of officers or N.C.O.'s, or small detachments operating at medium distances. They will eventually meet corresponding groups of the enemy who by means of automatic fire may hold up the reconnaissance for a long time. But the enemy screen must be broken through and the cavalry with machine guns will attempt this; in case of failure they will maintain contact with the enemy and the squadron of cyclists and the machine-gun squadron will try to overwhelm the enemy with their fire and so permit the cavalry to pass on. As a result of this mode of action a number of local actions will occur, generally on the outskirts of a wood or village, which the enemy will have prepared for defence. Eventually contact will be made with the enemy front and further advance becomes impossible. Under the orders of the Colonel commanding, the group will take up positions and endeavour to hold the ground until the arrival of the infantry, when they will retire to the rear of the column. The "groups" do not usually take part in the battle; they may be used to police the roads, guard prisoners, or they may hold a quiet sector of a defensive position. In pursuit of the enemy the reconnaissance groups play an important part; they must at once regain touch with the enemy, attack convoys, harass rear-guards, and open the road for the advance guards of the army. In a defensive action the "groups" are not engaged unless in order to hold a position in which it is necessary to use every means and throw in the last reserves.

In a retreat the groups are frequently employed in a defensive action and work with the rear-guards.

The medical personnel attached to reconnaissance groups is as follows:—

Reconnaissance Group of an Army Corps	Medical officers	Hospital attendants		Stretcher-bearers		Drivers	Ordnance
		N.C.O.'s.	Men	N.C.O.'s.	Men		
Headquarters ..	1 (mounted)	1 (on the ambulance wagon)	2 (mounted)	1	8	2	1 (bicycle)

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Group of squadrons	—	—	2	—	—	—	—
Cyclist squadron ..	—	—	2	—	—	—	—
Reconnaissance Group of an Infantry Division							
Headquarters ..	1	—	—	—	—	2	-
Squadron	—	—	1	—	—	—	—
Cyclist squadron ..	—	—	2 (one may be a corporal)	—	—	—	—

The divisional group is very poorly provided with medical personnel: only 1 medical officer, 3 nursing orderlies, each with his unit, and 2 drivers, one of whom is in charge of the vehicle carrying material for protection against gas. There is no one with the medical officer at headquarters. This distribution of personnel will probably be reconsidered later on.

The transport allotted to the reconnaissance groups is as follows :—

	Horses			Vehicles			
R.G. of an Army Corps	Saddle		Draught	Reg.	For wounded	Material	Bicycles
	Officers	Men					
Headquarters ..	1	2	3	1	1	—	10
Group of squadrons	—	—	—	—	—	—	2
R.G. of an Infantry Div.							
Headquarters ..	1	—	3	1	—	1	2
Squadron	—	—	—	—	—	—	1

The transport of the Divisional R.G. is insufficient. There is no means of transport for the orderlies attached to the cyclist corps, and no transport for the wounded.

The medical equipment with the reconnaissance groups is as follows :—

R.G. of an Army Corps	Regimental equipment	Small wagons for wounded	Wallets in ambulances	Cases of instruments with orderlies	Bags of dressings	Ordinary stretchers	Wheeled stretchers
Headquarters ..	1	1	1	2	6	2	2
Group of squadrons	—	—	—	2	6	—	—
Cyclist squadron ..	—	—	2	2	—	—	—
R.G. of a Division							
Headquarters ..	1	—	1	1	1	—	—
Squadron	—	—	—	1	3	—	—
Cyclist squadron ..	—	—	—	2	2	—	—

The division is better supplied with material than with personnel. In the R.G. of the Corps there are 615 dressings : individual, 345 ; small, 164 ; medium 70 ; and large 36. In the R.G. of the Division : individual 260 ; small, 130 ; medium, 70, large, 36.

In peace time the functioning of the medical units has nothing of interest. The assemblage of so many units in one camp assists medical practice and the motor ambulances of the divisional group circulate round the camp and the communications removing the sick.

In war difficulty begins when units are scattered over a vast terrain. Medical units must be attached to the various detachments operating apart from the main body according to the number of their effectives. If the detachment is commanded by a major of cavalry, a medical officer will be attached. For small detachments an orderly is sufficient. There is no

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possibility of establishing aid-posts and using the normal system of evacuation. The advance is at the rate of six to eight kilometres an hour and the extent of the front in breadth and depth and ignorance of points of contact with the enemy prevent the establishment of any systematic line of evacuation. Wounded men must be dressed at once and placed in the means of transport provided, but as this consists of only two-wheeled stretchers and one small wagon for the wounded, application should be made for two motor ambulances for each reconnaissance group when these are detached or isolated. Arrangements should also be made for the replacement of the ambulances sent to the rear by a relay of vehicles established at the advance guards of the main body marching in the wake of the "groups." From the tactical point of view an active liaison should be maintained between the various "groups" and touch maintained with the senior medical officer, normally the D.D.M.S. of the Corps at the headquarters directing the operations, who will use all his resources to aid the evacuation of wounded men.

At the moment of contact with the enemy the losses may be heavy and groups of wounded may be formed and then later there may be the establishment of aid-posts to which a medical officer will be attached. At first only temporary assistance can be given by the stretcher-bearers, and wounded able to walk should be directed to the infantry following the groups, whose duty it is to take over the wounded from the reconnaissance groups and to dress and evacuate the fallen cavalry men who have not yet been attended to.

Colonel Schickelé thinks it may be possible to organize in the future a system of evacuation by making use of the bicycles of the wounded for the carriage of loaded stretchers on good roads.

In a delaying action the medical service will be deployed behind the troops, a strict liaison being maintained with the Commander, so that they can be disengaged in time.

Their duty is to dress wounded on the spot and to evacuate them rapidly, so that as few men as possible may fall into the hands of the enemy.

When holding a sector the "groups" will behave exactly like infantry, the usual aid-posts being formed. The stretcher-bearers and motor ambulances of the nearest division will assist the reconnaissance groups in the evacuation of their wounded.

In a retreat the reconnaissance groups will keep a close liaison with the rear-guards and the regimental medical services of these will collaborate with those of the groups in a common action. In pursuit of the enemy the medical service of the groups will behave in much the same way as at the commencement of an ordinary reconnaissance and will seek assistance from the regimental medical service of the nearest infantry.

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Review.

La Guerra di Ogni Giorno. By Lieutenant-Colonel Arturo Casarini, Italian Army Medical Service. 1929. Rome : Tipografia del Senato. Pp. xii + 345.

This book is written with the object of instructing non-medical officers in the elements of medical science so that they may carry out sanitary precepts with efficiency and understanding. It differs very markedly from the ordinary official textbooks in the fact that the author has laid himself out to interest his readers and is not relying on the imminence of an examination as a stimulus to study. The title—"The War of Every Day"—is chosen to attract the keen military student, and analogies are drawn between the warfare of armies and that which is continually being waged between the human body and the various influences which tend to destroy it.

The first chapter, a long one of a hundred pages, describes the organization and functioning of the defensive army, in other words, it treats of anatomy and physiology. It is very skilfully written, not avoiding essential technical terms, but leading up to and explaining them in simple language. A large number of semi-diagrammatic illustrations make the text easy to follow.

The heading of one section may be quoted as an example of the way in which the military analogies are followed : "The transport columns of provisions and munitions and of waste products. The central organ of movement of the transport columns. The main and side roads of communication of the cellular army. (Circulatory apparatus : blood, heart, vessels.)"

Chapter II deals with the hostile forces, classified as inanimate and animate—heat, cold, fatigue, microbes, insects, worms, snakes, rats and even dogs on account of their liability to rabies. Each item under these headings is discussed with sufficient attention to detail to make their influence in the production of disease clear without overburdening the reader's mind.

The next chapter discusses the intrinsic and extrinsic defences of the body, the protection afforded by the unbroken skin, the mucous membrane and glands of the respiratory tract, the gastric juice, immunity, cleanliness, rations, ventilation, inoculation and disinfection.

Under the heading of "The Great Battles of Every Day" are descriptions of the principal infectious diseases and the particular precautions to be taken to prevent their spread.

The book concludes with a section on first aid written on ordinary lines.

Colonel Casarini is to be congratulated on the way in which he has presented a most important subject in a manner in which we feel sure it will be easily read and easily assimilated by the executive officer. He has wisely refrained from condensing a large amount of material into a small space.

C. J. C.

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VOL. LIV. JUNE, 1930. No. 6.

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Journal
of the
Royal Army Medical Corps.

Original Communications.

A STUDY OF CERTAIN FEATURES IN CONNECTION WITH ENTERIC GROUP INFECTIONS IN THE ARMY IN INDIA.[1]

BY MAJOR J. A. MANIFOLD, D.S.O.
Royal Army Medical Corps.

I.—VALUE OF THE WIDAL TEST IN INOCULATED INDIVIDUALS.

II.—THE EFFECTS OF A ONE-CUBIC-CENTIMETRE DOSE OF T.A.B. VACCINE IN REINOCULATION.

III.—RESIDUAL INOCULATION AGGLUTININS.

IV.—RESULTS OF BLOOD-CULTURE IN BACTERIOLOGICAL DIAGNOSIS.

I.—VALUE OF THE WIDAL TEST IN INOCULATED INDIVIDUALS.

IN view of the mass of literature which has accumulated in the past fifteen years on the subject of the Widal test, its technique, value in diagnosis, etc., some apology would appear to be needed for bringing to notice a subject which has been so thoroughly discussed in all its details. Owing to the rapid development of the pathological service in the Army in India during the past four years and the resulting increase in the laboratory investigation of cases of pyrexia, the extent to which the Widal test may be regarded as a reliable aid in the diagnosis of the enteric group of fevers is once again exercising the minds both of the pathologists carrying out the test and of the physicians in charge of the cases.

There is a general impression among medical officers that the Widal

[1] Received for publication June 10, 1929.

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test in T.A.B. inoculated individuals ought to yield a positive diagnosis in *all* cases of enteric group infection, provided that strict attention is paid to a standard technique, sufficiency of tests, etc. Increasing observation of many enteric group infections with a fair proportion of anomalous Widal results is producing a frame of mind which is either frankly doubtful of the value of the test, or entirely antagonistic. If one may be forgiven for saying so, this attitude of mind shows that the experience which accumulated during and since the Great War has been forgotten or overlooked, with the result that the test is being brought into disrepute owing to supposed fantastic claims as to its infallibility.

That this frame of mind is not restricted to military medical circles in India we may see from an article in the *Lancet* of September 1, 1928 [1], in which we find it stated that the behaviour of agglutinins in inoculated persons is the same as in the uninoculated, except that in the inoculated they start from a definite level, whereas in the uninoculated they start from zero.

No stress is laid on the fact that clear-cut results may be expected in only a majority of cases, and that there will always remain a proportion of cases in which definite readings cannot be obtained.

It is also stated that in the inoculated it is essential to perform *at any rate* two tests at three to four-day intervals to demonstrate fluctuation in titre.

From an examination of the results of very many hundreds of Widal tests in triply inoculated individuals, it is easily seen that little or no value can be assigned to results in which only two tests have been carried out, and for the purposes of this inquiry all such have been discarded as mere waste paper. Three tests have been accepted in a few cases as giving information of value, and then only when covering a certain definite period after the onset of the disease. In the majority of cases at least four, or often five, tests are necessary before a diagnosis, about which there can be no possible doubt, is arrived at. It is probable that the difficulties in the reading of the test were not stressed, as the article in question was intended for the general medical public, but the effect on the mind of the general reader of such categorical statements is bound to be harmful should he ever be called upon to treat large numbers of cases of enteric group infection in triply inoculated individuals without previous experience. He will then find that in a certain run of cases the assistance in diagnosis on which he has been told by experts to rely is not forthcoming, and he may ultimately discard the test to the possible detriment of his correct diagnosis when applied over a large group of cases, as in contrast to only a few. This is practically the train of thought to which we appear to be progressing in India to-day, and for much the same reason.

A short summary of the various phases through which this subject has passed may be useful to demonstrate the fact that, although claims as to the infallibility of the test were made in the earlier stages of the war,

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further experience proved that only in a *majority* of cases could such excellent results be expected, and that, in a considerable minority, the Widal test could take the place neither of accurate bacteriological diagnosis nor of accurate clinical observation.

The first extensive study of the agglutination test in certain infectious diseases was carried out by Gruber and Durham in 1896. This work was followed up by Widal, who showed a few months later that the test could be utilized for diagnostic purposes in cases of typhoid fever. The next advance was due to Sir Almroth Wright[2], who introduced the sedimentation method in 1897.

Madsen [3], in 1902, introduced a method of measuring accurately the agglutinating power of serum which appears to have been too complicated for general purposes.

Dreyer [4], in 1906, published the details of his method, by which for the first time an accurate estimation of the agglutinating power of the serum during the course of, and following on, an attack of enteric group infection became generally available to all laboratories. The details of the method were made known to English writers in general by a translation in the *Journal of Pathology and Bacteriology* [5] in 1909.

The reasons necessitating the use of some such accurately standardized test are too well known to require any elaboration. Dreyer's macroscopic technique, possibly with certain small modifications, is used in a very large number of laboratories all over the world. The committee which reported on this method in Medical Research Council, Special Report Series, No. 51, was definite as to its advantages, and careful workers all over the world have amply confirmed its findings. It has been for some years now the official Army method, and no other method is employed in any military laboratory in India.

By 1909 much experimental work on antityphoid inoculation had been carried out at the Royal Army Medical College, Millbank, and the late Lieutenant-General Sir William Leishman was able to persuade the military authorities to reintroduce antityphoid inoculation in the Army as a voluntary measure. By 1911, 88 per cent of the British troops in India had been inoculated against typhoid fever. At the present day practically 100 per cent British and Indian troops are inoculated with the triple vaccine.

In 1909, in a report of the Enteric Fever Convalescent Depot at Naini Tal, the fact that antityphoid inoculation complicated to some extent the reading of the Widal test in typhoid cases was noted.

In the same year paratyphoid A fever was recognized in India, but was then considered a rarity. The incidence of this infection was subsequently found to be more common than had been thought, and in 1911 104 cases with two deaths were reported.

In 1910-1911, Major D. Harvey, R.A.M.C., and Major H. W. Grattan and Captain J. L. Wood, R.A.M.C. [6] [7], demonstrated the fact that

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an increasing complication had been added to the reading of the Widal test, in that the inoculation agglutinins to *Bacillus typhosus* were frequently increased in paratyphoid A infections, often remaining at a higher titre throughout the test than the A agglutinins, and that the titre of agglutination caused by paratyphoid A infection was generally very low. Charts were published illustrating the curves of agglutination found in such cases.

From this period until the outbreak of the Great War there is little to note. But from 1914 onwards, owing to the large numbers of "T" inoculated individuals in the Army, opinion became increasingly divided as to the value of the test. In 1915 Dreyer, Ainley Walker and Gibson [8] drew attention to the necessity for using Dreyer's technique, and making repeated tests at short intervals in order to establish a diagnosis. Given both above factors, they considered the agglutinin reaction to be the simplest and most reliable method of establishing a diagnosis in suspected cases of typhoid infection. Professor Dreyer again in 1915, at a meeting of the Royal Society of Medicine, stated that in *every case* bacteriologically proved to be a typhoid or paratyphoid B infection the agglutination method gave a positive diagnosis (100 per cent). In paratyphoid A infections the test failed in about 7 per cent of cases, the reason for this being that he had not realized at the time the frequently low titres of agglutination occurring in a certain number of paratyphoid A cases.

The introduction of T.A.B. vaccine early in 1916 added to the already existing difficulties, and opinion became even more divided than in former days as to the value of the test.

The Oxford School, represented by Professor Dreyer and Dr. Ainley Walker, maintained that, although new difficulties existed in the interpretation of Widal tests, these could be overcome if certain necessary precautions were taken [9] and certain limitations realized.

Dr. Ainley Walker, in November 26, 1916 [10], writes: "On the other hand, the agglutination tests, when suitably carried out and appropriately repeated, can be made to yield a *uniform* accurate diagnosis in cases examined during active infection. It has been shown by Dreyer and others to give accurate results over a long series of cases in which the diagnosis had been rendered absolute by isolation of the infective organism."

In the same paper he produces charts of 13 cases of enteric group infection, in which 8 out of the 13 he considers were "mild and atypical enteric." It may be noted that the number of cases illustrated is few, and that the question of what *percentage* of mild cases may be expected to yield these good results is not discussed.

By April, 1917, Dr. Ainley Walker had found no reason to modify his convictions as expressed in the article referred to above, but he again stressed the limitations which must be realized in the interpretation of the test as laid down previously by Dreyer, Gibson and himself [11].

The teachings of Professor Dreyer and his co-workers are given in brief, as in the series of cases to be discussed later these have been strictly followed in all respects:—

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(1) That Dreyer's technique and standardized emulsions be employed, and repeated tests at short intervals be carried out; an important test being that which is carried out early in the course of the disease to act as a base line for further observations.

(2) There will ensue a rise in the titre of agglutination to the bacillus causing the infection arriving at a maximum between the 16th and 24th day (usually 18th to 20th), followed by a fall at first rapid, subsequently slow, so that a high titre may be obtained for a long period.

(3) As regards the other members of the group, three things may happen: (*a*) A relatively slight rise; (*b*) no appreciable rise; (*c*) a marked rise synchronous with, or somewhat antecedent to, the rise for the infective bacillus, and followed subsequently by the usual fall.

(4) The diagnosis must not be based on a small rise such as 100-200 per cent, if it is clear that the maximum to that rise falls markedly outside the period of 16th to 24th day of disease. If a regular rise and fall of even only 100-200 per cent occurs in titre, and the maximum falls between 16th and 24th day of illness, the case is likely to be one of E group infection.

(5) Pyrexias of non-enteric origin will not give rise to fluctuation in inoculation agglutinins, provided that the infection occurs at a period later than two months after inoculation.

By observing the limitations given in para. 4 and strictly following the technique laid down uniform results may be expected.

This was not the experience of all workers. Lieutenant-Colonel H. Marrian Perry, in April, 1918 [12], writes as follows :—

"It would be ideal if the above results could always be arrived at. Often, however, it happens that a rise and fall in titre of two or of all three organisms occurs synchronously and to the same extent. In these cases, whilst it is evident that the infection is due to one member of the group, it is always difficult, and often impossible, to say precisely which organism is responsible. Under such circumstances the diagnosis of 'enteric group' appears to be the only one justifiable, unless the causal organism has been isolated."

And again, "Cases do occur in which bacteriological examinations fail to isolate the organisms, and agglutination readings are so level, or exhibit such a slight variation, that they afford no help in confirming the original diagnosis."

He considers that the failure may be due to the infection being mild and agglutinins being produced only to a slight extent; or, on the other hand, that the organism responsible for the infection may be only a feeble producer of agglutinins.

Medical Research Council Report, No. 51 [13], states : "It is not indeed always possible to interpret the results correctly, and it must be admitted

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that the diagnosis requires not only a good technique but considerable experience, while at times, and notably when the disease occurs immediately after inoculation, it may be *frankly impossible* by this method."

Garrow, in 1920 [14], writes that owing to the claims for infallibility of the Widal test in inoculated individuals (claims which he considers unjustified) being generally accepted, clinicians were tending to rely more and more on a laboratory diagnosis in cases resembling enteric group infections, to the great detriment of correct clinical diagnosis, which he considers all-important. Atypical enteric he considers to be a myth and largely due to naccurate clinical observation, in particular of certain essential cardinal signs, three at least of which are invariably present.

"Anti-enteric inoculation is the gift of practical bacteriology to preventive medicine. . . . It would be a strange irony if the full fruits of this victory were lost amid the clinical chaos resulting from the undue domination of bacteriology (and especially academic bacteriology) over clinical medicine."

It should be stated that Captain Garrow, while not admitting the infallibility of the Widal test in inoculated individuals, fully realized the value and accuracy of Dreyer's technique, *Lancet* (correspondence, 1916, ii, 1307). The writer has still vivid recollections of Captain Garrow explaining and demonstrating to him this technique many years ago in a certain station in Portuguese East Africa.

In 1923 the "Pathology" volume of the "Medical History of the War" [15] was published. The discussion of the enteric fevers, including the effects of inoculation, was undertaken by the late Sir William Leishman. His views in general appear to be fairly embraced in the following paragraph :—

"The history need not be followed in detail, and it will suffice to record here that towards the end of the year the different points of view had been very largely reconciled, and an increasing experience had demonstrated that, *within certain limits*, agglutination evidence could be relied upon to give a definite diagnostic result, even in men who had been inoculated with triple vaccine."

Again, on p. 236 he states, "In the *majority of cases* the agglutination curves were found to behave in characteristic fashion," and on p. 237, "In others, however, the curves proved either irregular or too small in amplitude to justify a diagnosis. Such border-line cases account for a considerable proportion, probably the majority, of the cases included under the diagnosis of enteric group which are analysed below."

It will be seen that there is no claim to the *uniform accurate results* which had been claimed by Dr. Ainley Walker in 1916, but only to a *majority* of the cases examined giving definite results.

An analysis of 223 cases of enteric group infection which could not be placed by the pathologists in any particular category is given. A special group of forty-three cases with very typical symptoms was also picked out for careful examination, and in only two was a definite diagnosis possible on Widal tests alone.

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In 1923 Pijper [16] reported a series of 120 undoubted cases of typhoid fever in which thirty-four, or 28 per cent, yielded a negative Widal reaction. It is to be noted that these cases were apparently in the main in uninoculated individuals. Dreyer's method was not used as a routine, but was employed in a certain number and gave no better results. This same worker, in April, 1928 [17], presents further instances in which complement-fixation tests gave better results than the Widal test in cases of typhoid fever. Apparently, by 1925 complement-fixation tests in the Pretoria Hospital had definitely replaced the Widal for routine purposes.

Felix and Olitzki [18] also state that not less than 27 per cent of a series of typhoid cases in Palestine yielded a serum at some stage or other of the disease that contained no H agglutinin but only O. In such cases, if only the usual formolized standardized emulsions had been employed the tests might have been negative.

The above summary has been drawn up merely to point out that exaggerated claims for the Widal tests as a means of diagnosis in inoculated or uninoculated individuals are *not* being made by those with considerable experience of its working at the present day. The difficulties in the interpretation of the results are discussed later, but it may be pointed out that one cause of the unsatisfactory results appears to have been brought to light by the work of Weil and Felix, who have stressed the phenomenon of variability in certain bacilli (among others the enteric group bacilli) depending on the relative development of two antigenic components, i.e., the labile H, or flagellar, and the stable O, or somatic, antigen. Among the enteric group bacilli the former gives rise to large flaking agglutinins and the latter to fine granular agglutinins.

These observers have shown that, in a certain proportion of enteric group infections, the H agglutinins may be entirely absent, with resulting negative Widal results if ordinary formolized suspensions are used.

It is interesting to note that Harvey and Wood, of the Royal Army Medical Corps, working at the Naini Tal Enteric Depot in 1908-09, noted the difference between O and H agglutinins, and published their observations in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, vol. xiv, 1910, page 401.

These were cases of paratyphoid infection in men who had been inoculated against typhoid only; the infection agglutinins showed in low dilution as a fine granular haze, whereas the inoculation agglutinins were floccular and readily distinguishable.

Felix and Olitzki [18] consider that the difficulties may be overcome by using two separate emulsions, namely, an alcoholized O emulsion to demonstrate the O agglutinins, and a formolized emulsion to demonstrate the H agglutinins.[1]

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[1] Since the above was written, an important article by A. Felix, in the *Journal of Hygiene*, February, 1929, has come to hand. Certain of his conclusions are noted later.

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Stuart and Krikorian [19] make use of living emulsions of particular strains of enteric group bacilli, specially selected as being rich in either the O or H antigens.

Some definite O variants of *B. typhosus* have already been received by Major R. F. Bridges, R.A.M.C., at the Enteric Laboratory, Kasauli, and routine tests using O emulsions as well as the ordinary formolized standard H emulsions are being carried out in several military laboratories. Results of this work it is hoped will be available at the end of the present year.

From a study of the literature of past years it will be seen that there are very few *exact details* available for any large series of bacteriologically-proved enteric infections in triply-inoculated individuals. Statements are very general. Such phrases as "in the majority of cases," "a certain percentage" only are found.

In the "Pathology" volume of the "Medical History of the War," Sir William Leishman quotes the findings in sixteen cases of bacteriologically-proved typhoid fever with sufficient Widal tests carried out during the course of the disease, and states that the curve of the typhoid agglutinins was here typical in *most instances*. Similar results were given by nineteen cases of paratyphoid A infection, but in a fair number of these the first observations had not been made early enough to detect the initial rise, and this "could only be assumed by the steepness of the fall after the 22nd or 24th day." The paratyphoid B cases number sixty-four, but the percentage of these cases which could definitely have been accepted on their agglutination tests as paratyphoid B is not given. It is stated that "occasional low readings are recorded, and in one case no B agglutinins were found at all."

In past years the laboratory investigation of cases of pyrexia in the military hospitals for Indian troops does not appear to have been as thorough as among British troops. The gradual introduction of Indian station military hospitals from 1917, in lieu of the regimental hospital system, and the reorganization of the pathological service in 1925, led to an increasing interest in cases of pyrexia. In 1928, in particular, considerable attention was paid by many Deputy Assistant Directors of Pathology and officers in charge of Indian military hospitals to the milder types of pyrexia among Indian troops, the result being that the extent of typhoid infection in Indian troops, largely of a mild nature, is beginning to be actually realized, although suspected for some time (see Table I).

It should be made clear that the Regulations for the Medical Services of the Army in India only permit a diagnosis of typhoid, paratyphoid A, or paratyphoid B fever, when the causative bacillus has been isolated by the District or Brigade Laboratory, and later confirmed as such by the Enteric Laboratory, Kasauli. All cases diagnosed on clinical grounds alone are included under the diagnosis "enteric group," irrespective of whether the Widal tests show a rising curve of agglutination or not. The results of Widal tests in standard agglutinin units, and all other important details

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TABLE I.—STATEMENT SHOWING ACTUAL ADMISSIONS AND RATIOS PER 1,000 OF STRENGTH AGAINST EACH COMPONENT OF ENTERIC GROUP OF FEVERS AND PYREXIAS OF UNCERTAIN ORIGIN FOR THE YEARS 1920-28.

British Troops.

Year	Average annual strength	Typhoid fever		Paratyphoid A		Paratyphoid B		Paratyphoid C		Enteric group		Pyrexia of uncertain origin	
		Admissions	Ratio	Admissions	Ratio	Admissions	Ratio	Admissions	Ratio	Admissions	Ratio	Admissions	Ratio
1920	57,332	46	0·8	42	0·7	1	0·02	—	—	173	3·0	116	2·0
1921	58,681	43	0·7	25	0·4	6	0·1	1	0·02	127	2·2	37	0·6
1922	60,166	66	1·1	16	0·3	2	0·03	2	0·03	94	1·6	41	0·7
1923	63,139	44	0·7	21	0·3	11	0·2	—	—	68	1·1	37	0·6
1924	58,614	62	1·1	30	0·5	10	0·2	—	—	79	1·3	32	0·5
1925	57,378	53	0·9	26	0·5	26	0·5	—	—	79	1·4	32	0·6
1926	56,798	57	1·0	18	0·3	4	0·1	1	0·02	72	1·3	38	0·7
1927	55,632	30	0·5	10	0·2	8	0·1	1	0·02	120	2·2	22	0·4
1928	55,991	55	1·0	16	0·3	7	0·1	—	—	111	2·0	23	0·4
						Indian Troops.							
1920	216,445	17	0·1	8	0·04	—	—	—	—	104	0·5	307	1·4
1921	175,384	23	0·1	9	0·05	3	0·02	2	0.01	82	0·5	212	1·2
1922	147,840	33	0·2	21	0·1	5	0·03	—	—	46	0·3	36	0·2
1923	143,234	23	0·2	12	0·1	4	0·03	—	—	37	0·3	32	0·2
1924	134,742	19	0·1	6	0·04	1	0·01	—	—	33	0·2	54	0·4
1925	136,473	33	0·2	11	0·1	7	0·1	—	—	47	0·3	53	0·4
1926	135,146	20	0·1	9	0·1	2	0·01	—	—	48	0·4	14	0·1
1927	133,082	47	0·4	15	0·1	6	0·05	—	—	97	0·7	14	0·1
1928	131,324	154	1·2	27	0·2	13	0·1	2	0·02	154	1·2	15	0·1

regarding the cases, are entered on Army Form I 3056, which on completion of the case is forwarded to Army Headquarters for perusal and retention.

Owing to the fact that a considerable percentage of irregular results in Widal tests on enteric group cases were being encountered in all laboratories, a search was made in the literature available for some definite figures on the subject which, based on a large series of cases, might act as a standard for laboratories to work by. Exact details appeared, however, to be very few and generalizations many.

Deputy Assistant Directors of Pathology were therefore asked to carry out as many tests as possible on all bacteriologically proved enteric infections in addition to their routine tests on the "enteric group" cases (i.e. clinical cases not bacteriologically proved). The tests on bacteriologically proven typhoid and paratyphoid A cases seem now sufficient in number to give the required information, and the results of a smaller number of tests on the paratyphoid B cases of sufficient interest for discussion, although of no value as an indication as to the percentage of positive results which may be expected in a series of proved cases.

Series of tests carried out on many hundreds of cases have been carefully scrutinized, and those only selected in which there are available sufficient

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tests carried out over a sufficiently long period after the onset of the disease to give the information required.

The average number of tests per case in the 522 bacteriologically proven and group cases selected works out at 4·39 tests per case. In over 70 per cent the first test had been carried out before the 8th day from the onset of the disease. In many two tests were carried out before this date. The remainder have had their first test sufficiently early in the course of the disease to enable a rise to be followed in the agglutinin titre if such occurred, e.g., 9th, 10th, 11th days.

The fact that these 500 series of Widal tests have been carried out by not one, but many bacteriologists in different laboratories, seems of importance in estimating the value of the test in actual laboratory practice. All the bacteriologists have wide experience of the test and, it may be said, were brought up on Dreyer's technique.

For practical purposes 2-3 c.c. of blood are required to provide sufficient serum to enable the technique to be carried out satisfactorily against, T, A, B and C emulsions, and thus the custom in the Army is to withdraw the necessary blood by vein puncture.

The tests have been carried out at varying intervals of time, either at four-day, five-day, or seven-day intervals.

It is possible that more absolutely accurate results might have been obtained by a Widal test carried out in all cases during the first week of illness, and then by further tests on the 12th, 16th, 20th, 24th, 28th, and 32nd day of the disease, as has indeed been done in quite a large number of cases in the present series, but that such a rigid series of tests can have any application in general practice is more than doubtful. There presumably must be some limit to the endurance of the patient. The main value of the test, from a practical point of view, is in the diagnosis of the milder forms of enteric fever with pyrexia of nine to fourteen days duration. It is somewhat hard to persuade a patient who has suffered from little except a slight headache for two days, in addition to a mild pyrexia and possibly some constipation for a week, of the necessity of having blood withdrawn from his median basilic vein at intervals up to the 28th day from the date of onset of his trouble. In 99 cases out of 100 the British or Indian soldier will cheerfully offer up a few cubic centimetres of his blood on the altar of science, if requested to do so by his medical officer prior to proceeding to the hockey field for his afternoon's recreation, but it is doubtful whether this would be the case in civil practice. Yet these are the cases in which a diagnosis is really required. In the severe toxic cases the physician in charge of the case has no doubt regarding his diagnosis, and thus there is little or no danger of the patient infecting others, whether a bacteriological diagnosis has been arrived at or not.

Until the end of 1927 standardized emulsions obtained from the Standards Laboratory, Oxford, were universally employed. During 1928 these have been prepared at the Enteric Laboratory, Kasauli, by Major R.

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F. Bridges, R.A.M.C., and it may be said that they have given as good results as those formerly obtained from Oxford. A subculture of all enteric group bacilli isolated in the military laboratories is forwarded to the Enteric Laboratory, Kasauli, and unless the bacteriological diagnosis of the District or Brigade laboratory is confirmed, the diagnosis of the case remains "enteric group."

The procedure followed in this study has been to examine carefully the results of tests on the bacteriologically proven cases, working out the percentage rise in the titre of agglutination to each bacillus, and then to examine the enteric group cases in a similar manner. The limitations in the reading of the tests, as laid down by Dreyer and Ainley Walker, have been carefully observed, with the exception that in some cases a rise to a maximum as early as the 15th day (in a few cases even earlier) has been accepted as a positive result, if the effect on the agglutination titre for the other bacilli has been negligible.

The term "nil units" used throughout the series of tests implies that no evidence of agglutination is present in a titre of 1 in 25, the lowest dilution of serum employed.

The 522 cases selected fall into the following groups :—

Enteric group	295	131 British cases 164 Indian cases	Cases clinically diagnosed and no specific bacilli isolated
Bacteriologically proven typhoid	152	52 British cases 100 Indian cases	Specific bacillus isolated and confirmed at the Enteric Laboratory, Kasauli
Bacteriologically proven paratyphoid A	51	24 British cases 27 Indian cases	
Bacteriologically proven paratyphoid B	24	11 British cases 13 Indian cases	

RESULTS OF WIDAL TESTS ON 152 BACTERIOLOGICALLY PROVEN TYPHOID FEVER CASES.

(*Average Widal Tests per Case* 4·45.)

Severe cases ..	84	(55·2 per cent); average pyrexia ..		26·17 days
Mild cases ..	68	(44·7 per cent) ,, ,, ..		14·9 ,,
British ..	52	32 severe cases ,, ,, ..		26 ,,
		20 mild cases ,, ,, ..		13·6 ,,
Indian ..	100	52 severe cases ,, ,, ..		26·35 ,,
		48 mild cases ,, ,, ..		16·3 ,,

Of 52 British cases, 33 or 63·4 per cent could have been classified as typhoid fever on their Widal tests alone.

Of 100 Indian cases, 64 or 64 per cent could have been classified as typhoid fever on their Widal tests alone.

There remains a considerable minority of cases in which, had the infective bacillus not been isolated, a diagnosis of typhoid fever could not have been arrived at, in spite of repeated Widal tests.

If the 84 severe cases are taken in one group, 75 per cent can be classified as typhoid fever, whereas if the 68 mild cases are taken in one group, only 50 per cent could be so classified.

It is evident that when a *large group* of typhoid infections is under

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consideration, the severity of infection influences to a considerable extent the production of infection agglutinins as distinct from inoculation agglutinins. When individual cases only are considered, this is by no means the case. Occasionally a severe case may lead to little or no rise in the agglutinin titre throughout the illness, and a case classified as mild may show a distinctive rise considerably greater than in many severe cases, for example:—

Case I, 24.—Severe.

	3rd	8th	12th	16th	23rd	28th	35th day		
B. typhosus ..	0	8	5	0	0	0	0	S.A. units	Severe case, 48 days pyrexia. *B. typhosus* isolated from blood on 2nd day, and from urine on 45th day. Inoculated with 1 c.c. T.A.B. 569 days before onset
B. paratyphosus A ..	43	72	67	57	60	75	60		
B. paratyphosus B ..	56	200	53	55	85	11	63		

Case B, 15.—Mild.

	6th	17th	25th	32nd day		
B. typhosus ..	5	24	96	431	S.A. units	Mild case, 12 days pyrexia. *B. typhosus* isolated from stools on 11th day. Inoculated with 1 c.c. T.A.B. 138 days before onset
B. paratyphosus A ..	21	21	21	21		
B. paratyphosus B ..	8	8	0	17		

When, however, the *very mild* cases of typhoid fever are examined in a group by themselves, for which purpose 24 cases in which pyrexia continued for not more than 11 days are available, it is found that only 37·5 per cent are classifiable by their Widal tests (9 out of 24).

The agglutination results recorded in certain of these cases are illustrated later when discussing the results of tests on the typhoid cases unclassifiable by their Widal tests.

That poor results are often met with in mild infections was noted by Marrian Perry [12], working in France during the war, and also by Sir William Leishman [15], when summing up the results of agglutination tests at the end of the war. Actual figures, however, are not given by either writer. That the results are as poor in these very mild or abortive typhoid infections has been an unpleasant surprise.

WIDAL TESTS ON 37 BACTERIOLOGICALLY PROVEN TYPHOID CASES WHICH COULD BE DIAGNOSED ALSO ON THEIR WIDAL RESULTS (SEE APPENDIX I).

Severe cases: 63 or 64·9 per cent (average pyrexia 27·1 days)
Mild cases: 34 or 35 ,, (,, ,, 17·1 ,,)

British troops, 33 per cent classifiable			Indian troops, 64 per cent classifiable		
Rise in T.A.B. ..	9 or 27·2 per cent	63·4 per cent	Rise in T.A.B. ..	14 or 21·8 per cent	54·5 per cent
Rise in T. & B. only	9 or 27·2 ,,		Rise in T. & B. only	17 or 26·5 ,,	
Rise in T. & A. only	3 or 9 ,,		Rise in T. & A. only	4 or 6·2 ,,	
Rise in T. only ..	12 or 36·3 ,,		Rise in T. only ..	29 or 45·3 ,,	

In both British and Indian cases the synchronous rise in "A" and "B" is marked, and the "B" agglutinins are more affected than "A."

The actual details of the extent of the rises in the severe and mild cases for "T," "A" and "B" agglutinins respectively are given in Appendix I.

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The "A" agglutinins are affected in practically the same percentage in the severe and mild groups, slightly more so in the latter, viz., 30 per cent in the severe and 32·2 per cent in the mild. The severe infections, however, tend to produce a greater rise than the mild. Taken all round, the rise is small. In 66·6 per cent it is under 200 per cent.

The "B" agglutinins are affected in a larger number of cases, 49·2 per cent of the severe and 52·9 per cent of the mild. In 71·4 per cent the rise is under 200 per cent.

In the classifiable cases, therefore, although the inoculation agglutinins show a synchronous rise in approximately 60 per cent of the cases, in the majority the rise has been small and presents little difficulty in diagnosis. In the unclassifiable group, as will be seen later, the synchronous rise in the inoculation agglutinins has been one of the main difficulties.

The "T" standard agglutinin units in these classifiable cases show naturally a greater rise than either "A" or "B" units. Of the severe cases 55·5 per cent give over 1,000 per cent rise, in most cases many thousands per cent. The milder show a smaller percentage with over 1,000 per cent rises, viz., 32·3 per cent. The above points will be clear if reference is made to the tables in the Appendix. Before discussing these agglutination reactions further, the unclassifiable group of cases will be examined in order to demonstrate the contrast between the results of the Widal tests on this group and on the classifiable cases.

WIDAL TESTS ON 55 CASES OF BACTERIOLOGICALLY PROVEN *B. typhosus* INFECTIONS, WHICH COULD *not* HAVE BEEN CLASSIFIED ON THEIR WIDAL RESULTS.

The distribution of cases into Severe and Mild is almost exactly the reverse of that found in the classifiable cases.

Severe cases: 21 or 38·1 per cent (average 25·3 days pyrexia)
Mild cases: 34 or 61·8 ,, (,, 12·7 ,, ,,)

British troops, 19 cases			Indian troops, 36 cases		
Rise in T.A.B. ..	6 or 31·5 per cent	68·3 per cent	Rise in T.A.B. ..	13 or 36 per cent	66·6 per cent
Rise in T. & B. only	5 or 26·3 ,,		Rise in T. & B. only	7 or 19 ,,	
Rise in T. & A. only	2 or 10·5 ,,		Rise in T. & A. only	4 or 11·1 ,,	
Nil rise in T. ..	6 or 31·5 ,,		*Nil* rise in T. ..	12 or 33·3 ,,	

The synchronous rise in inoculation agglutinins is more in evidence, and the rise in the specific "T" agglutinins is distinctly lower on the whole. In over 30 per cent no rise occurs during the period over which the tests were carried out.

The slight increase in the amount of the "T" S.A. units is shown in Appendix I.

The severity of the attack is an important factor, as out of the 21 severe cases 19, or 90·4 per cent, do show some rise in the "T" units, even if only a trace, whereas only 18 of the 34 mild cases (52·9 per cent) show a similar rise.

Both "A" and "B" agglutinin units are raised to a greater extent than

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was found among the classifiable classes, i.e., in the severe group "A" units are raised in 61·8 per cent, and "B" units in 71·4 per cent. In the mild group "A" units are affected in 50 per cent and "B" in 79·4 per cent.

The "B" element is again involved to a greater extent than the "A" element. It is noted that in both classifiable and unclassifiable groups the "B" units appear to be affected in a greater number of instances in the mild cases than in the severe. The cases in which no rise in "T" infection units occurred amount to 18 (11·1 per cent of 152 cases), 2 severe and 16 mild. In 9 (1 severe) there is an actual drop from the first test onwards. In 6 "nil units" are shown throughout the tests.

The average number of tests in these 18 cases is 4. The duration of the pyrexia in the 16 mild cases averaged 11·5 days, and in 7 it was under 10 days. The tests on the single severe case in which a drop in titre from the original test occurred are not very satisfactory, in that no estimation was done between the 19th and 37th days, but there is a definite drop to the 19th day, and the S.A. units on the 37th day were 200 per cent less than on the 10th day.

The results of a few tests are given to illustrate the intervals between the tests and the type of case involved in those showing no rise or a definite drop in the specific agglutinins.

B, 7.—Fairly severe case, pyrexia 17 days, 1 relapse, pyrexia 17 days. *B. typhosus* isolated from blood on 8th day and from stools on 23rd day. Inoculated with 1 c.c. T.A.B. 144 days prior to onset of illness. Tests on 9th, 15th, 20th, 25th day—nil S.A. units to "T."

I, 12.—Mild case, pyrexia 6 days. *B. typhosus* isolated from blood on 4th day. Inoculated with 1 c.c. T.A.B. 256 days prior to onset of illness. Tests on 5th, 17th, 22nd, 29th day—nil S.A. units to "T."

I, 17.—Mild case, pyrexia 8 days. *B. typhosus* isolated from stools on 22nd day during examination for carrier condition. Inoculated with 1 c.c. T.A.B. 111 days before onset of illness. Tests on 4th, 10th, 17th, 24th day —nil S.A. units to "T."

I, 14.—Mild case, pyrexia 15 days. *B. typhosus* isolated from blood on 3rd day. Inoculated with 1 c.c. T.A.B. 73 days before onset of illness.

3rd	8th	12th	16th	22nd	26th	33rd day	
50	50	43	25	8	9	10	S.A. units to "T."

B, 8.—Mild case, pyrexia 11 days. *B. typhosus* isolated from stools during examination for carrier condition. Inoculated with ½ and 1 c.c. T.A.B. 615 days before onset of illness.

8th	15th	22nd	30th	37th day	
46	35	38	17	20	S.A. units to "T."

There is little indication of any general tendency to the rise or fall in the inoculation agglutinins being earlier or later than the infection agglutinins, though instances do occur in which each effect is seen.

An important point is whether any of the irregular Widal tests recorded

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in this group would have led to a diagnosis of paratyphoid A or B in lieu of typhoid fever had *B. typhosus* not been isolated. If so, a similar error may be expected in the reading of tests of enteric group cases.

The "A" agglutinins actually show a higher rise than those for "T" in 23 of the 55 cases, or 41·8 per cent. Most are irregular and followed by a sudden drop. In others the rise occurs at a very late period. In many there is quite a steady rise throughout. The rise in "T" or "B" agglutinins in the great majority approximated so closely that no diagnosis other than enteric group could have been possible.

Two cases, 1·2 per cent, only would have been classified as paratyphoid A :—

Case I, 27.

	7th	19th	16th	21st day		
B. typhosus	26	46	52	59	S.A. units	*B. typhosus* isolated from blood on 7th day and stools on 35th day. Pyrexia 19 days, fairly severe. Inoculated with 1 c.c. T.A.B. 258 days prior to onset
B. paratyphosus A ..	8	16	41	64		
B. paratyphosus B ..	4	5	4	11		

Case I, 19.

	6th	13th	21st	44th	58th day		
B. typhosus	20	9	9	8	8	S A. units	*B. typhosus* isolated from blood on 6th day. Pyrexia 9 days only. Inoculated with 1 c.c. T.A.B. 354 days prior to onset
B. paratyphosus A ..	3	14	54	250	94		
B. paratyphosus B ..	0	0	0	0	0		

"B" agglutinins show a higher rise than "T" in 32 of the 55 cases, or 58·1 per cent, i.e., 9 more cases than "A."

The same remarks regarding the character of the rises apply as in the case of A, but a larger number of cases would have been classified as paratyphoid B on Widal tests alone.

Five would have been definitely so classified, viz., 3·2 per cent of 152 cases, and three other cases are very near the border line.

The tests on two cases which would have been considered as paratyphoid B and on one of the doubtful cases are shown below.

Case B, 17.

	10th	17th	24th	31st	38th	50th	57th day		
B. typhosus	0	0	0	7	7	22	23	S.A. units	*B. typhosus* isolated from blood on 10th day. Pyrexia 11 days, mild. Inoculated with 1 c.c. T.A.B. 374 days prior to onset
B. paratyphosus A ..	7	4	7	6	0	0	5		
B. paratyphosus B ..	0	0	18	46	20	58	23		

Case I, 24.

	4th	10th	15th	20th day		
B. typhosus	0	185	435	174	S.A. units	*B. typhosus* isolated from blood on 3rd day. Pyrexia 19 days, moderate. Inoculated with ½ and 1 c.c. T.A.B. 8 days before onset
B. paratyphosus A ..	0	0	0	0		
B. paratyphosus B ..	11	1,111	1,633	1,533		

Case I, 16.

	4th	8th	12th	17th	23rd	31st	38th day		
B. typhosus	0	0	0	6	0	3	6	S.A. units	*B. typhosus* isolated from blood on 4th day. Pyrexia 11 days, mild. Inoculated with 1 c.c. T.A.B. 61 days prior to onset
B. paratyphosus A ..	13	13	23	34	10	26	32		
B. paratyphosus B ..	11	13	21	38	13	21	56		

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From the examination of the tests on 55 cases (36·1 per cent) of typhoid fever which could not have been classified as such by Widal tests only, it is seen that the rise in the inoculation agglutinins, particularly as regards the "B" element, most affected in mild cases, is the great obstacle to a definite reading. The difficulty is intensified by the small rise which may occur in the "T" infection agglutinins, particularly in mild cases.

In 18, or 11·1 per cent of 152 typhoid cases (16 mild), the infection agglutinins were apparently not affected throughout the period of the tests.

In examining a large number of enteric group infections by their Widal tests alone, the error in regard to the typhoid infections might therefore be at least as large as 1·2 per cent wrongly classified as paratyphoid A, and 3·2 per cent as paratyphoid B.

The 97 cases which would have been classifiable on Widal tests alone may now be examined again in order to ascertain to what extent they agree with what may be taken as the usual teaching, namely, that the rise in S.A. units from the base line resulting from inoculation should be first apparent about the 10th to 12th day, should steadily increase to a maximum between the 16th and 24th day (usually 18th to 20th), and should be followed by a fall at first rapid, subsequently slow, possibly to the base line of inoculation, but frequently remaining at a high level for long periods.

It is impossible to give accurate figures regarding these points from the scrutiny of a large number of cases in which the serum has been collected on different days after the onset of the disease, and at varying intervals of time. In general, the majority of the tests may be said to fall in with the above teaching. On the other hand, there remains a *large minority* in which, although ultimately classifiable if sufficient tests are carried out, the results are found to be irregular in many respects. For example :—

(1) In a large number the peak of the curve appears to be nearer the 16th day than the 20th, and in a few the peak is reached well before this date.

Case B, 16.

	5th	12th	19th	26th day		
B. typhosus ..	472	1,159	694	326	S.A. units	Severe case, pyrexia 32 days. *B. typhosus* isolated from blood on 4th and 7th days and on 39th day from urine. Inoculated with 1 c.c. T.A.B. 196 days before onset
B. paratyphosus A ..	21	21	12	6		
B. paratyphosus B ..	25	17	17	21		

Case I, 50.

	5th	11th	16th	21st day		
B. typhosus ..	155	287	163	155	S.A. units	Severe case, pyrexia 23 days. *B. typhosus* isolated on 5th and 6th days from blood. Inoculated with 1 c c. T.A.B. 132 days before onset
B. paratyphosus A ..	0	0	0	0		
B. paratyphosus B ..	9	0	0	0		

(2) In many the initial rise is late in making its appearance.

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Case I, 61.

	6th	11th	18th	22nd day		
B. typhosus ..	0	2	0	860	S.A. units	Severe case, 28 days pyrexia. Intestinal hæmorrhage, recovery. *B. typhosus* isolated from blood on 6th day and stools on 10th day. Inoculated with 1 c.c. T.A.B. 287 days before onset
B. paratyphosus A ..	0	0	0	0		
B. paratyphosus B ..	0	0	0	0		

Case I, 26.

	6th	15th	20th	25th	32nd	39th	45th	52nd	60th day	
B. typhosus	0	0	0	0	5	46	27	5	7	S.A. units
B. paratyphosus A ..	11	11	11	11	16	15	11	8	14	
B. paratyphosus B ..	25	10	25	10	17	25	10	7	13	

The case was severe, pyrexia 38 days' duration, no relapse. *B. typhosus* isolated from blood on 6th day. Inoculated with two doses T.A.B. 389 days before onset.

This is an extreme case of a late rise, and if only the "usual" tests had been carried out, or if *B. typhosus* had not been isolated, this case would certainly have remained as enteric group.

(3) In a considerable number the peak of the curve is found to be reached after the 24th day if tests at a sufficiently late period are carried out to show this, and in many there occurs a secondary rise well on in convalescence.

Case B, 18.

	9th	16th	23rd	30th	69th	76th	83rd	91st day	
B. typhosus	179	476	539	793	20	347	392	450	S.A. units
B. paratyphosus A ..	0	0	6	97	8	0	4	3	
B. paratyphosus B ..	0	0	13	30	3	3	3	3	

This case is interesting in that the percentage rise in both "A" and "B" units is distinctly larger than in the case of the "T" units. The mathematical accuracy required by Dreyer's method in the reading of tests such as above, in which the relative rise in agglutinin units to each element is to be measured against the similar rise in the other two elements, rather than by taking into consideration the actual number of agglutinin units present, seems rather to break down in certain cases, such as the above, in which one or other element shows few or no agglutinin units at the time of the initial test. Common sense would appear to indicate that the above infection was really typhoid and not paratyphoid A. The secondary rise in this case is due to a relapse which occurred on the 59th day. *B. typhosus* was isolated from the blood on the 9th and 10th day, and again during the relapse. It was also recovered on many occasions from the stools and urine. The patient was inoculated with 1 c.c. T.A.B. 93 days before onset of disease.

(4) The following two cases illustrate well the late rise in convalescence, which frequently occurs, apart from any relapse.

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Case I, 42.

	17th	23rd	29th	38th	42nd	53rd	60th	70th day	
B. typhosus	152	154	98	154	72	129	510	1,100	S.A. units
B. paratyphosus A ..	30	38	15	34	39	32	34	28	
B. paratyphosus B ..	62	72	21·4	55	71	71	110	110	

Severe case, 31 days pyrexia. *B. typhosus* isolated from blood on 9th day, and from stools on 43rd day after onset.

Case I, 45.

	6th	13th	20th	27th	34th	41st	48th	55th	64th day	
B. typhosus	15	0	2·9	25·5	195	34	49	49	980	S.A. units
B. paratyphosus A ..	39	13	13	10·6	2·9	10	14·5	6·9	9·9	
B. paratyphosus B ..	39	213	55	36	27·5	28	31	12·2	31	

A severe case, pyrexia 38 days, no relapse. *B. typhosus* isolated from stool on 23rd day Inoculated with 1 c.c. T.A.B. 184 days before onset.

Almost all the irregularities which can be met with are shown by this test: Drop on 13th day, late initial rise, late peak of agglutination curve, secondary rise in convalescence.

(5) The large majority of cases definitely demonstrate a higher agglutinin content to the infecting bacillus at the end of the series of tests than at the commencement, but by no means all.

Case I, 12.

	4th	8th	13th	23rd day		
B. typhosus	45	68	68	17	S.A. units	Severe case, 28 days pyrexia. *B. typhosus* isolated from blood on 4th day. Inoculated with 1 c.c. T.A.B. 200 days before onset
B. paratyphosus A ..	7	5	0	0		
B. paratyphosus B ..	21	9	9	9		

(6) In a number of cases the actual number of standard agglutinin units for the specific element was less throughout the series of tests than in the case of "A" or "B," and at the completion of the tests fewer S.A. units were present to "T" than to "A" or "B." The results of tests taken weeks after an attack of enteric group infection with a view to ascertaining the nature of that infection must therefore be very fallacious.

Case I, 32.

	5th	9th	14th	21st	28th	38th	43rd	48th day	
B. typhosus	0	0	0	235	116	38	19	9·9	S.A. units
B. paratyphosus A ..	0	0	0	14	11	7·7	9·1	18	
B. paratyphosus B ..	0	0	0	5	5	7·2	17	14	

Severe attack, 24 days pyrexia. *B. typhosus* isolated from blood on 5th day. Inoculated with 1 c.c. T.A.B. 100 days before onset.

(7) In a small percentage of cases, in lieu of the usual rise in titre about 10th to 12th day, a definite drop may occur (Case I, 45 above).

In 106 of these 152 cases, the second, or in some instances the third, test coincided with 10th to 12th day.

In 62 or 58·4 per cent a definite rise was apparent.

In 31 or 29·2 per cent no rise had occurred.

In 13 or 12·2 per cent a definite drop was present, in most cases to be followed by a rise at the next test.

The above examples show that even among those cases which could be

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classified on their Widal results, almost any departure from what has been quoted above as the normal may be met with in quite a large number of instances. It is obvious that at least four tests will usually be required for efficient diagnosis, and in a certain number of cases even more. Two tests only would be entirely unreliable in the majority of cases.

For practical purposes the most suitable periods at which to carry out the tests in order to include all types of reactions appear to be: the first on any day during the first week, and the remainder on the 14th, 21st, 26th, 31st days after the onset of the disease. Tests carried out at four-day intervals from the 14th day to the 30th day would be more accurate, but would entail six tests per patient, which seems unduly severe, particularly in mild cases.

Sir William Leishman [15] writes, "The older view, that exceptionally severe cases show a very poor development of agglutinins, is not borne out by the recorded observations of fatal T, A and B cases in France."

It is also contrary to experience in India. There were 9 deaths in the 152 cases under discussion. In 8 there was present a considerable and steady rise in the agglutinin content to "T" up to the last test, carried out usually a day or two before death occurred. No difficulty would have arisen regarding the diagnosis of any of these cases on their Widal tests alone.

The effect of a relapse on the development of the specific agglutinins was marked in most cases. In all, 29 relapses are recorded (severe cases 23, mild 6). In 11 the Widal tests were continued during the period covered by the relapse; 9 of these show a marked development of both specific and group agglutinins. In one case no units to "T" were present up to the 25th day, but were high after the subsequent relapse, and in another the S.A. units only returned to and increased over their original number at the first test after a relapse which commenced on the 38th day.

Case I, 17.

	6th	14th	25th	Relapse 36-45th	51st day		
B. typhosus ..	0	0	0	..	5,333	..	S.A. units

Case I, 40.

	2nd	10th	18th	24th	Relapse 24th-32nd	32nd	42nd	50th	56th day	
B. typhosus ..	0	0	23	9·9	..	4,000	32,000	16,000	10,000	S.A. units

Case I, 41.

	6th	12th	17th	24th	28th	35th	Relapse 28-35th	42nd	49th	58th	66th day	
B. typhosus ..	175	49	22	7	7·8	35	..	87	510	165	143	S.A. units

RESULTS OF WIDAL TESTS ON 51 BACTERIOLOGICALLY PROVEN PARATYPHOID A CASES.
(SEE APPENDIX II.)

Total cases: 51 (British 24, Indian 27).
Severe cases: 9 (17·6 per cent) average duration of pyrexia 25·5 days
Mild cases: 42 (82·3 ,,) ,, ,, ,, 16·8 ,,
Average number of tests per case: 4·1
32 cases, or 62·7 per cent, are classifiable by agglutination.

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Owing to the small number of severe cases in this group no distinction is made between the Widal results of the severe and mild cases. Two of the severe cases could not have been classified on their Widal tests, and in both this was due to the close rise in the inoculation agglutinins of "T" and "B"

Classifiable 32 or 62·7 per cent		Unclassifiable 19 or 37·2 per cent	
Rise in T.A.B. .. 9 or 28·1 per cent	59·3 per cent	Rise in T.A.B. .. 5	
Rise in T. & A. only 4 or 12·5 ,,		Rise in T. & A. only 3	52·6 per cent
Rise in A. & B. only 6 or 18·7 ,,		Rise in A. & B. only 2	
Rise in A only .. 13 or 40·6 ,,		*Nil* rise to A. 9 or 47·3 per cent	

In 46·8 per cent of the classifiable cases the rise of the "A" agglutinins is over 1,000 per cent, in many several thousands per cent. In 59·3 per cent it is over 500 per cent. A greater percentage of this group therefore gives good agglutination reactions than in the case of the classifiable mild typhoid cases.

In the 19 unclassifiable cases the failure in the development of the "A" agglutinins is the main source of difficulty. The rise in inoculation agglutinins plays a smaller part than was the case with the unclassifiable typhoid cases, both as regards the percentage of cases involved and the extent of the rise.

The maximum rise to "A" is only above 300 per cent in two cases. In one of these the rise was present on the 11th day, but had disappeared again by the 15th day. In 17·6 per cent of the 51 cases there is no rise throughout to "A" agglutinins, as against the 11·1 per cent of the typhoid infections in which no rise in the specific agglutinins occurred.

The frequent occurrence of this weak agglutination reaction in "A" infections was pointed out as long ago as 1910 by Harvey, Grattan and Wood, in India [6] [7]. In the classifiable group the majority of the cases fall in with the usual teaching as regards the rise and fall in specific agglutinins, as seen in the similar group among the typhoid cases, but again all the irregularities met with in the typhoid group, i.e., late rise, early peak of curve of agglutination, late peak of curve ef agglutination, drop from first test, secondary rise after an initial fall, are seen in a certain number.

Martin and Upjohn [20] in 1916, and MacAdam [21] in 1918, drew attention to the fact that a late rise in agglutinins frequently occurred in paratyphoid "A" infections. Out of 17 classifiable cases in which the initial test has been carried out during the first week, a rise was apparent by 9th to 12th day in 13. In the 9 cases which show "no rise" in "A" throughout the period covered by the test, the day after onset on which the last test was taken was as follows: 28th, 27th, 40th, 49th, 34th, 27th, 41st, 18th, 20th day. In only the last two cases could there have been much chance of a late rise being missed.

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A few late rises did occur, but it is doubtful if such are more common in the case of "A" infections than in "T" infections, and the inoculation agglutinins seem usually to be affected at the same time (Case I, 16).

Case I, 15.

	4th	13th	15th	27th day		
B. typhosus	0	0	0	0	S.A. units	Mild case, pyrexia 13 days. *B. paratyphosus* A isolated from blood on 4th day, and urine on 16th day. Inoculated with 1 c.c. T.A.B. 20 days before onset.
B. paratyphosus A ..	0	0	0	27		
B. paratyphosus B ..	10	23	0	12		

Case I, 16.

	7th	11th	15th	20th	27th	34th	41st day		
B. typhosus ..	18	23	26	31	10	18	40	S.A. units	Severe case, pyrexia 27 days. *B. paratyphosus* A isolated from blood cultures on 7th day. Inoculated with 1 c.c. T.A.B. 313 days before onset
B. paratyphosus A	11	10	11	0	5	8	37		
B. paratyphosus B	46	36	12	34	7	7	50		

The fact that paratyphoid "A" infections induced a rise in "T" agglutinins in "T" inoculated individuals was also pointed out by Harvey, Grattan and Wood [6] [7] in 1910, 1911.

In the present series of cases a rise occurred in "T" in 21, or 41·1 per cent of 51 cases, 13 classifiable, and 8 unclassifiable.

In the former group no rise occurred until the 19th day in 4 cases. In 9 the rise was apparent by the 12th to 13th day, but no further rise or a sudden drop followed in all but 2, in which a steady rise occurred during the period of the test—Case I, 16 is an example.

The extent of the rise to "T" was greater than that to "A" in all 8 unclassifiable cases, but in all either a sudden rise was followed by a sudden drop, or the difference in extent of the rise between "A" and "T" or "A" and "B" was insufficient to lead to any diagnosis other than enteric group.

Case I. 17.

	5th	9th	13th	17th	21st	29th	36th day		
B. typhosus ..	94	139	31	35	24	8	3	S.A. units	Mild case, pyrexia 11 days. *B. paratyphosus* A isolated from blood on 5th day. Inoculated with 1 c.c. T.A.B. 27 days before onset.
B. paratyphosus A	217	245	61	61	61	31	10		
B. paratyphosus B	200	226	176	56	56	22	11		

"B" agglutinins were raised in 25, or 47·8 per cent of 51 cases, 15 classifiable, and 6 unclassifiable, a slightly larger percentage than in the case of "T." The extent of the maximum rise is greater than the rise in "A" in 6 cases, but, as in "T," no other diagnosis than enteric group would have been possible owing to either the irregularity or trivial nature of the increase, or the presence of a nearly equal rise in "A" or "T" agglutinins.

(To be continued.)

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CANTONMENT HEALTH ADMINISTRATION.

By Major A. E. RICHMOND, O.B.E.
Royal Army Medical Corps.

(*Continued from p.* 367.)

VI.—The Prevention of Smallpox.

An epidemic of smallpox is an almost ever-present menace in most cantonments in India.

The Indian Vaccination Act, which provides for the compulsory vaccination of the more youthful elements of the population, can be made applicable to a cantonment provided the necessary official sanction is given to the step by the Local Government, and, as far as the writer knows, it is in force in all, or practically all, stations.

This Act, apart from its main purpose already indicated, allows of the making of the necessary bye-laws and regulations in order to ensure that its provisions are complied with, and permits the appointment of public vaccinators, the establishment of vaccination stations, the fixing of the vaccination season (the cooler months of the year), and other essential measures. The vaccination station is usually situated in the cantonment hospital, and is under the ægis of the medical officer in charge of the latter.

In the event of the Vaccination Act for any reason not being in force, general public vaccination can, in an outbreak of smallpox, threatened or actual, be enforced as a special measure under Section 151 of the Cantonments Act already referred to (*vide supra*), and it will be realized that this affords a valuable second line of defence.

Without an efficient system of registration of births, the proper carrying out of compulsory vaccination is an extraordinarily difficult matter, and in reference to this it should be borne in mind that the registration of births, marriages and deaths is one of those subjects in regard to which the Cantonment Authority is at liberty to frame bye-laws.

In the writer's experience, however, and probably in that of many readers also, it is an extraordinarily difficult matter to induce a cantonment, or other Indian population, with its large percentage of illiterate people to report births, marriages and deaths to the registration authority in accordance with the bye-laws on the subject. The cantonment can be plastered with notices in regard to the matter, the town crier can ring his bell and proclaim the regulations having reference to it until he is, metaphorically speaking, blue in the face, people can be threatened with condign punishments for failing to register events of the nature alluded to, and all

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conceivable measures can be adopted to ensure that the bye-laws are compiled with, but the net result will usually be that not more than thirty per cent of the births, marriages and deaths in the cantonment are correctly notified, and even the fining of offenders will not produce any much greater effect than this.

The appointment of a good public vaccinator is a matter of extreme moment in diminishing the risk of a smallpox epidemic, but it is no use expecting the cantonment population voluntarily to present themselves or bring their children for vaccination, and they require to be persistently hunted, by written notices and personal visits, to the vaccination station. The public vaccinator plays an important part in this, and the size of the protected element among the cantonment inhabitants is directly proportionate to the amount of energy he expends in personally keeping in touch with all parts of the station.

Unfortunately, to be visited by the goddess Mata (smallpox) is looked upon as a blessing by the Hindu section of the Indian community, and there is no doubt that this belief plays a considerable part in ensuring a heavier incidence of the disease in an epidemic than would otherwise be the case.

It is for this reason, too, among others, that so much trouble is experienced in outbreaks of smallpox, on account of the concealment in houses of cases of the disease. Those responsible can, of course, be summoned under the Cantonments Act for non-notification, but this frequently does not deter them, and a house to house search for such patients may become a necessity. On one occasion in the experience of the writer, when this was being done, he arrived on the flat roof of one house in time to find a smallpox patient being lowered on to the roof of the neighbouring house which had just been searched, and in which the parents had hoped to put the case out of sight until the searchers had departed. The lengths to which many, including the most enlightened Indians, will go on occasions to hide cases of smallpox and other infectious diseases as well, are almost unbelievable, and the practice forms a very serious obstacle in many instances to dealing rapidly and effectively with an epidemic.

VII.—The Prevention of Rabies.

The prevention of rabies, a disease which is endemic in most parts of India, lies almost entirely in the proper control of dogs, and this is ensured, as far as possible, by the Cantonments Act and bye-laws made under it. All dogs must be registered and must wear a collar, together with a metal badge issued by the registration authority.

Under the Act the Cantonment Authority may cause to be destroyed, or confined for any period necessary, a dog or other animal reasonably suspected to be suffering from rabies, or which has been bitten by such an

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animal. It may direct that, after a specified date, any dogs without collars or marks distinguishing them as private property, found straying beyond the enclosures of the houses of their owners, be destroyed, and they may be dealt with accordingly.

The Cantonment Authority may also order the use of muzzles and chain leads when rabies is prevalent.

Penalties are prescribed against those contravening the Act or orders issued under it, and it is stipulated that any person knowing or having reason to believe that any dog or animal belonging to him, or in his charge, has been bitten by an animal suffering from rabies, must give immediate information to the Executive Officer (s. 119).

Unfortunately, in spite of the powers possessed by cantonment authorities, rabies contiuues to be more or less prevalent in most stations, this being due largely to the fact that the disease is imported so frequently from the neighbouring cities or townships where usually no system of control of dogs is in existence, while an additional factor which plays a part is the wide extent to which the malady is present in jackals, and the habits of these animals which bring them close to, or into, cantonments at night in search of food.

It is often the case that cantonment authorities employ one or more dog-shooters on whole-time duty whose work is to destroy wandering and unowned dogs. It is very much more satisfactory if soldiers are employed for this purpose if they can be made available, as it is frequently a matter of some difficulty to find Indians who will undertake the task, or who do not, after a few days' trial, throw up the job on account of their being haunted at nights by the ghosts of the animals they have slain.

The keeping down of the numbers of pariah dogs in a cantonment is a matter of much importance and requires careful attention on the part of the authorities concerned.

VIII.—Powers of Entry and Seizure.

The Cantonments Act gives the power of entry into, or upon, any building or land to the President or Vice-President of the Board, the Executive Officer, the Health or Assistant Health Officer, or any person authorized by the two last-named, or by the Board, in order to make any inquiry or inspection, or to execute any work, authorized by or under, or required for the purposes of, the Act (s. 241).

Similarly, the Cantonment Authority may depute any person to inspect any drain, privy, latrine, urinal, cesspool, pipe, sewer or channel, and, in his discretion, to cause the ground to be opened for the purpose of preventing or removing any nuisance arising from one of the sources referred to (s. 243). Provision is also made under this section for the apportionment of the expenses of the work.

Unless expressly arranged for in the Act, entry must not be made

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except between sunrise and sunset, and four hours' notice must be given to the occupier or owner concerned, except in the case of a stable, cattleshed, latrine, privy or urinal, or a work under construction, while due regard must be paid to social and religious usages (ss. 246, 247, 248).

Any door, gate, or barrier may be opened if this is necessary for the purpose of such entry, or if the owner or occupier is absent or refuses to open the obstruction.

In addition to the provisions of the Cantonments Act, in respect of powers of entry, already alluded to, one important section permits entry *at any time* into markets, buildings, shops, stalls, or other premises in the cantonment, for the inspection of animals, articles or things intended for sale as human food or drink, or for medicine, irrespective of whether it is for sale, storage, manufacture, or preparation of the foodstuff or medicine that the places are used.

The same section of the Act allows of the seizure of any diseased or unwholesome animal, or other foodstuff, or of medicine, food or drink that is adulterated or not what it is represented to be, or of any utensil or vessel of such a kind, or in such a state as to render any article prepared, manufactured, or contained in it unwholesome or unfit for human consumption, while any perishable article so seized and unfit for consumption may, under the orders of the Health Officer or the Assistant Health Officer, be destroyed, provided, if it is not so destroyed, it is taken before a magistrate.

Penalties to a maximum of 100 rupees may be imposed on offenders against this important section of the Act (s. 215), and it is wise to note that assistance is given at the conclusion of the section in regard to the definition of the terms, "not what it is represented to be" and "unfit for human food."

Comment appears unnecessary in regard to the provisions of the Act concerned with powers of entry and seizure mentioned above, but it is of moment to bear in mind the restrictions laid down, particularly in reference to entry, as if the latter is made at times or under circumstances not covered by the terms of the Act, the individual concerned is liable to find himself summoned for trespass.

IX.—Slaughter Houses and Markets.

The provisions of the Cantonments Act give to the Cantonment Authority wide powers in relation to the supervision and control of slaughter houses and markets.

It is authorized to provide and maintain such a number of these as it thinks fit, and has the requisite right of entry for purposes of inspection, and of closure, if this is necessary, in the interests of the health of the cantonment (s. 198).

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No one is permitted to expose any animal or article for sale in a public market without the approval of the Board (s. 199), and no place can be used as a public market or slaughter house unless a licence for the purpose has been granted officially; this latter, however, not being necessary in the case of the killing of an animal anywhere on the occasion of a festival or ceremony, provided necessary conditions as to prior, or subsequent, notice are complied with, according as the authority concerned directs (s. 202).

Penalties are prescribed under the Act for those who either keep markets or slaughter houses open without a licence, or put articles up for sale, or slaughter animals, as the case may be, in unauthorized places (ss. 204, 205).

Any servant of the Board, duly commissioned in writing by the President, or by the Health Officer, may enter and inspect, by day or by night, any place in which he has reason to believe that illegal slaughtering is being carried on, but in this connexion it is important to note that the written authorization must specify the place to be visited, its locality, and the period for which the order is in force; in reference to the latter point, the period should not exceed seven days (s. 207).

Bye-laws having as their object the proper control of markets and abattoirs are a necessity in all cantonments, and the Board is permitted to frame regulations of this nature dealing with the days and hours of slaughtering, or of selling in markets, as the case may be, the design, ventilation, drainage and sanitation in general of the buildings devoted to these purposes, the stalling of animals prior to killing, the method of slaughtering, the disposal or destruction of carcases unfit for consumption, and other relevant matters (s. 208).

Finally, an important section of the Act lays down expressly that no person may, without the sanction of the Cantonment Authority, bring into a cantonment any animal intended for human consumption, or the flesh of any beast killed outside the cantonment, otherwise than in a Government or Cantonment Authority controlled slaughter house. Any animals or flesh introduced in contravention of this section may be seized and sold, or disposed of by the responsible authority, the proceeds being allocated to the Cantonment Fund, while the offenders concerned may be punished with a fine.

It is desirable, however, to note that the restrictions outlined in the preceding paragraph do not apply in the case of meat brought into the cantonment privately for private domestic consumption, as distinct from that for sale to the public.

It will be recognized from a perusal of the foregoing that the provisions of the Act mentioned, in a general way, restrict the selling of goods and slaughtering to specified and licensed places, ensure that such premises are properly constructed and sanitary, and put a ban on the killing of animals and sale of goods anywhere and everywhere throughout the cantonment, regardless of the suitability of the premises for the purpose.

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X.—Prostitution.

As regards the removal and exclusion of prostitutes and the suppression of sexual immorality, exceptional powers lie in the hands of the Commanding Officer of the cantonment as distinct from the Cantonment Board.

In the event of his receiving information that any building is being used as a brothel or for purposes of prostitution, he may, after inquiry, direct the owner, lessee, tenant, or occupier to discontinue employing the place for such a purpose (s. 235), while if he is satisfied that any individual residing in or frequenting the cantonment is a prostitute, or has been convicted of loitering for the purpose of prostitution, or of importuning to the commission of sexual immorality, or of abetting such an offence, he may by means of an order in writing expel the culprit from the station, and prohibit her or him from re-entering it (ss. 236 and 237).

Somewhat similar powers lie to the hand of a magistrate of the first class having jurisdiction in a cantonment, but, as regards actual expulsion of offenders and their prohibition from returning, he must furnish his recommendations to the Commanding Officer, with whom any further action in the matter rests.

The practical results of the sections of the Cantonments Act alluded to, tending, as will have been observed, to prohibit anything in the nature of brothels, licensed or otherwise, is that prostitutes are driven on to the roads and by-ways, and are completely out of control from the point of view of medical supervision and inspection, and although much has been done of recent years to improve the lot of the soldier in India and to give him a sufficiency of healthy interests in addition to his work, yet it is very questionable whether such an ideal state of affairs has been reached as renders a limited form of authorized prostitution unessential.

The incidence of venereal disease among troops is still comparatively heavy, and although there are numbers of ladies of easy virtue, professional and casual, among the Indian women in a cantonment, yet it is a most unusual thing for any one of them to be dealt with and expelled under the terms of the Act.

The reason is not far to seek and lies in the fact that the apprehension of offenders in the darkness of the roads and by-ways of the average cantonment is always a difficult matter, while the ordinary soldier is very loath to lay a charge of soliciting against a woman, until he finds he has infected himself with disease, by which time it is too late, as more often than not he has but the haziest recollection of the woman's appearance, and has of a certainty no knowledge of her name or lodging.

Apart from these difficulties just mentioned, "graft" undoubtedly plays its part, while even if a cantonment is by energetic measures denuded of its prostitutes, the trouble still remains of women of this class temporarily imported for the night from the neighbouring city by tonga drivers and

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others, their concealment during the journey frequently being effected by hiding them under the seats of the vehicles, putting them in sacks, and by other more or less ingenious subterfuges, so that they may escape the eye of any more than usually watchful policeman.

It will probably be agreed by many readers that it is a pity that the Cantonments Act does not allow of, at any rate, a mild form of licensed and supervised prostitution.

XI.—Burial and Burning Grounds.

No place in a cantonment, which was not used as a burial or burning ground before the Act of 1924 came into force, may be used for a purpose of this nature without the written permission of the Cantonment Authority (s. 146), and the latter may accompany its sanction with the imposition of any conditions it may deem necessary with a view to preventing annoyance and danger to health of persons residing in the neighbourhood (s. 146).

Should the Board be of opinion that any burial or burning ground has become offensive or insanitary, it may, with the previous sanction of the Local Government, require the owner or individual in charge to close the place, provided he is informed at the same time as to the conditions consequent upon the fulfilment of which the ground may again be taken into use (ss. 146 and 147).

Little else of importance is laid down in the Act in regard to areas used for interment and cremation, except that the Cantonment Authority may require the owners or persons in charge of such places to supply any information wanted concerning their condition, management, position, etc. (s. 145), and may by public notice prescribe routes in the cantonment by which alone corpses may be removed there.

The authority concerned is, under the sections of the Act quoted, given ample powers for dealing with burial and burning grounds from a health point of view, and no remarks on the subject appear necessary.

XII.—Hospitalization.

Under the provisions of the Act the Cantonment Authority may provide or maintain as many hospitals and dispensaries as it thinks fit, or may make a grant-in-aid to any such institution not supported by it, while every hospital or dispensary so maintained or assisted must have attached to it a ward or wards for the treatment of persons suffering from infectious or contagious diseases (s. 171).

At such establishments the sick poor of the cantonment, and other inhabitants suffering from infectious or contagious disease, may be treated free of cost, and, if looked after as in-patients, may be either dieted gratuitously or be granted subsistence allowances on such a scale as the Cantonment Authority may deem suitable (s. 173), while those who are

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ineligible for free treatment can be admitted as patients at charges previously fixed by the authority concerned (s. 174).

The sections of the Act mentioned deal with hospitalization in the ordinary way, but the fact must not be lost sight of that epidemics of infectious disease may arrive very unexpectedly, and it is essential that cantonment authorities should have some scheme ready in advance by which the necessary, and possibly much increased, isolation accommodation for infectious patients may be available in a very short space of time, and should not have to rely on the military authorities to lend tentage and other equipment to deal with the situation. Apart from provision for augmented hospital accommodation of this nature, it is wise to have arrangements made by which a definite area is retained for use, should need arise, as a quarantine camp, and that the requisite material for the construction of temporary shelters for those in quarantine is easily obtainable.

XIII.—Bye-laws.

The Cantonment Authority is empowered under the Cantonments Act to make bye-laws in regard to certain matters, but before being brought into force it is necessary that they be approved by the Local Government and published in the local official gazette.

Matters of importance from a health point of view in connection with which such bye-laws may be made comprise the following:—

(1) Registration of births, marriages, and deaths, and the taking of a census.

(2) Enforcement of compulsory vaccination.

(3) Regulation of the construction, alteration, maintenance, preservation, cleansing, and repairs of drains, ventilation shafts, pipes, water-closets, privies, latrines, urinals, cesspools and other drainage works.

(4) Regulation or prohibition of the discharge into or deposit in drains of sewage, polluted water, and other offensive or obstructive matter.

(5) Regulation or prohibition of the stabling or herding of animals or any class of animals so as to prevent danger to the public health.

(6) The proper disposal of corpses, and the regulation and management of burial and burning places.

(7) The regulation and control of encamping grounds, pounds, washing places, serais, hotels, dâk bungalows, lodging houses, boarding houses, clubs, restaurants, cafés and places of public recreation or entertainment.

(8) The regulation of ventilation, lighting, cleansing, drainage, and water supply of the buildings used for the manufacture or sale of aerated or other potable waters, and of butter, milk, sweetmeats, and other articles of food and drink for human consumption.

(9) Matters regarding which conditions may be imposed by licences granted under Section 210 of the Cantonments Act (*vide infra*).

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(10) The control and supervision of places where dangerous or offensive trades are carried on.

(11) The fixing and regulation of the use of public bathing and washing places.

(12) The regulation or prohibition for purposes of sanitation or prevention of disease of any act which occasions or is likely to occasion a nuisance, for the regulation or prohibition of which no provision is made elsewhere in the Cantonments Act.

(13) The prevention of the spread of infectious or contagious diseases within the cantonment.

(14) The segregation or removal from the cantonment or destruction of animals suffering or reasonably suspected to be suffering from any infectious or contagious disease.

(15) The supervision, regulation, conservation and protection from injury, contamination, or trespass of sources and means of public water supply, and of appliances for the distribution of water, whether within or without the cantonment limits.

A matter of particular importance, among those just mentioned, in regard to which bye-laws may be framed, is that of the conditions which may be imposed in respect of licences granted for the carrying out of certain trades and occupations within the cantonment.

Those callings which are of moment from a health point of view and for the prosecution of which licences are requisite comprise those of butcher, poultry, game or fishmonger, pig-keeper or dealer, keeper for profit of milch cattle or milch goats or other animals, dairyman, butterman, maker or vendor of ghee, bread, biscuit, or cake-maker or vendor, fruit and vegetable dealer, aerated water or other potable water manufacturer, ice or ice-cream maker or seller, vendor of medicines, drugs, or articles of food or drink for human consumption which are of a perishable nature, water-seller, washerman, maker or seller of sugar and sweetmeats, vendor of wheat, rice, or other flour grain, and an individual engaged in an offensive trade (s. 210).

Licences in respect of these occupations are issued for one year on payment of the necessary charges, and on the backs of the licences are printed the conditions under which they are issued. These vary to some extent, it is presumed, in each cantonment, but in all cases certain basic points of importance from a health aspect should be covered by them, and when inspecting trade premises the medical officer concerned should make it a habit to call for the licence and to make certain first that its conditions are being complied with, as far as they affect his particular province.

It should not be forgotten that the proprietors of hotels, cafés, and eating houses of all descriptions must have licences, and it is by the conditions imposed by these that a strict control can be exercised over the general cleanliness and sanitation of these places, which are so important from a health point of view, apart from any such control obtained by bye-laws made under sub-para. 7 above.

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It would not appear necessary to make any further remarks in respect of those matters which may be covered by bye-laws, as the situation as a whole in regard to them seems clear.

We have now considered the chief matters of importance, from a health point of view, with which the Cantonments Act deals, but it behoves us to mention certain other points in this connexion upon which the provisions of the Act touch.

Of these, one of some moment is that the Local Government may, on application being made by the Cantonment Authority concerned, extend to any area beyond the cantonment, provided it is in its vicinity, and with or without restrictions or modifications, any of the provisions of the Cantonments Act contained in Sections 118 to 279, or of any rule or bye-law made under it which relates to the subject matter of the chapters, which comprise the sections named, and any enactment, rule, or bye-law so extended thereupon applies to that area as if it were in the cantonment. Broadly speaking, this means that any of the provisions of the measure referred to relative to matters of health may be applied to such an area, so that we have here a means of applying suitable measures to insanitary places on the borders of a cantonment which are likely to prejudice the health of the inhabitants within its boundaries.

Another, though less important, point on which the Cantonment Acts throws enlightenment is the definition of the term "nuisance." It will be realized that we are concerned with what we may call sanitary nuisances, as distinct from those which are general in type, but in any case if one is faced with difficulty in the interpretation of the word from a legal point of view, a reference to Section 118 of the Act will be of much assistance, as therein is given a long list of what may be considered to comprise nuisances.

In much the same way trouble is often experienced in deciding as to whether a given condition of affairs may be said to constitute an "insanitary state" or not, and in this matter the Act gives us no help. One can only say that common sense must be relied on, and that it is wise in such cases to remember that two heads are better than one.

In dealing with the matter of the prevention of infectious and contagious diseases, no definition of what these include was given. The Cantonments Act mentions the point and, in the list of definitions given in Chapter I, we find that diseases of the nature alluded to comprise cholera, leprosy, typhoid and paratyphoid fever, smallpox, tuberculosis, diphtheria, plague, influenza, venereal disease, and any other epidemic, endemic, or infectious disease, which the Local Government may by notification in the local official gazette declare to be an infectious or contagious disease for the purposes of the Act. This latter group will normally include any diseases of the kind referred to which are not specificially mentioned in the definition given and which are of any importance from a health point of view.

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Finally, two sections of the Act dealing with noxious vegetation and agriculture, and irrigation, should not be left out of consideration.

Under these the Cantonment Authority may by notice in writing require the owner, lessee, or occupier, of any land to clear away thick or noxious vegetation, or undergrowth, likely to be injurious to health or offensive to persons residing in the neighbourhood, and may also prohibit any cultivation or the use of any kind of manure, or irrigation of any land in any specified manner likely to be injurious to the health of persons dwelling in the vicinity, or may have the method of carrying it out altered as necessity directs. It is easy to realize that the provisions of these two last-mentioned sections strengthen to a material degree the hands of those engaged in the prevention of malaria in an Indian military station.

Many readers who have battled through to the conclusion of this article no doubt find themselves in a state of bewilderment as to how it is that, with the extensive powers indicated and placed in the hands of the responsible authorities, cantonments are not as a whole in a far more perfect hygienic state than is the case at present.

Certain explanations offer themselves, and of these, one of major importance is the fact that, when originally planned and built, all the attention that might have been directed to the health aspect of the question was not given, with the result that cantonment authorities are frequently faced with defective conditions of various kinds and magnitudes which have been in existence for decades, and the rectification of which can only be accomplished very gradually indeed, funds not allowing of anything else, while lack of money is also responsible in many cases for preventing the replacement of old-fashioned methods of sanitation and conservancy by measures of a newer and more modern type.

Apart from financial considerations, the habitual ignorance and apathy of the average Indian, the large proportion of illiterate persons in most Indian communities, religious beliefs, conservatism, vested interests, anti-British sentiments, and the prevalence of the usual amount of "graft," are all factors which militate against progress to a far greater extent than in western countries, even though it may be passive antipathy rather than active opposition which they engender.

The fact remains, however, that much progress in the hygiene of cantonments as a whole has been and is being made.

It might be well to remind ourselves that we have been dealing throughout with what we may term the civilian aspect of cantonment health administration, and not with its military side.

Over barrack hygiene in cantonments the military authorities, of course, exercise complete control and are at liberty, when need arises, to place any area, shop, café, bazaar, etc., out of bounds to troops, and to impose any restrictions they like in regard to civilians in barracks, and other matters of similar importance for the prevention of disease in the military

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element of the population. Naturally, " placing out of bounds " is a powerful weapon, and used reasonably and justifiably can do more than anything else to make hotel and café owners, and proprietors of similar types of places, keep their premises reasonably clean and sanitary.

In conclusion the writer, while making apology for the length of this article and for inflicting it on those who peruse it, yet pleads in justification the difficulties he himself met with during a period while holding a minor health appointment in an Indian cantonment.

He would also like to thank very much Major D. T. Richardson, M.C., R.A.M.C., Assistant Professor of Hygiene at the R.A.M. College, for perusing the article and for offering valuable suggestions in reference to the arrangement of the subject matter and other points.

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THE CANTONMENT ANTIMALARIA PROBLEM AFTERTHOUGHTS.

By Major T. O. THOMPSON,
Royal Army Medical Corps,
AND
Captain P. F. A. GRANT, O.B.E.,
Indian Medical Service.

(*Continued from p.* 376.)

(3) On the Use of Prophylactic Quinine.

Major Mansell has brought up this subject in an article in the Journal of the Royal Army Medical Corps of February, 1929, in which he writes on an "Experiment in Prophylaxis." This consisted of the administration of quinine, thirty grains daily for eight days after leaving the last malarious camp, up or down, on a certain hill journey, i.e., to cover the "normal incubation period." He presents some very gratifying histograms to show the result without and with treatment at the mid-season move period. His contrast is not, however, of selected men during the same period, but of the same period in two different years.

We suggest that this article should not be called "An Experiment in Prophylaxis," but "A Result of Early Treatment." His method is really a mass treatment of potentially infected groups.

He states that quinine was given for eight days to cover the normal incubation period. Surely this is a somewhat short time. The normal time, even for *P. falciparum*, is given by several authorities as nine to twelve days, and for the other plasmodia as fourteen to twenty-one days. Even with artificial infection for purposes of treatment, periods of five to thirty-one days resulted, and only by intravenous methods were periods of four to eight days obtained. In the Meerut District this method of early mass treatment of potentially infected, i.e., all men returning from leave through malarious Terai areas, was regularly employed in four stations. The results were satisfactory in that men were kept available for full duty and out of hospital, but there was no claim that this was either a true prophylactic or curative method for the majority of cases.

In many countries eminent malariologists have expressed the opinion that prophylactic quinine is valueless in preventing malarial infection. Yorke and Macfie recently have shown that administration of quinine, for five days before and seven days after bites by infected anophelines, failed to prevent malaria.

Colonel A. B. Fry, after considerable experience on plantations and

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with selected groups in Assam, definitely stated that he had no faith in prophylactic quinine.

Webber has shown that quinine given to a donor does not render his blood uninfective to a susceptible person, and that anophelines can be infected by the blood of a person taking quinine.

In Macedonia Wenyon reported quinine prophylaxis during the war to have been a failure.

Knowles and Senior-White state that: "quinine has no destructive action on the malarial sporozoites injected into man by the infected mosquito," but "in reality acts as a very early treatment of a malarial infection," and that "the good old custom of handing round a bottle of five-grain tablets of quinine every evening at dinner with the sherry and soup has nothing to recommend it."

It has been shown in the Panama Canal zone that a compulsory fifteen grains daily, taken under supervision, and which was certainly rarely missed, did not prevent infection in three groups of engineers working outside the sanitated areas. Of 225 men, during four and a half months in the jungle, only fourteen showed malaria, but from two weeks after the cessation of the quinine, malaria occurred in a veritable epidemic which subsided after five weeks. The writers of the article on this incident, in the *American Journal of Tropical Medicine*, conclude that these facts are confirmatory, that fifteen grains of quinine will not prevent malaria, "but by suppressing symptoms and keeping men on their feet has a high military value in a malarious region."

Major Mansell's results, as shown by his histograms, appear most gratifying, but:—

(1) The year 1928 was an exceptionally dry year and healthy, with low malaria rates in large areas, and many stations may well have shown similar results.

(2) This dry and healthy season particularly affected the hill road areas just at the time of the mid-season moves.

Possibly Major Mansell is too optimistic as the result of a single set of figures.

Another form of the prophylactic use of quinine which does appear to be of value, however, is the treatment of obvious reservoirs of infection in the troop lines. By this is meant the treatment of all malarious children of troops and followers in all units in a station, not specially to benefit the children, but as a prophylactic for the troops. This is a method of prevention which appears to hold out considerable prospects of good results, and has been largely carried out in certain stations in the Meerut district.

(4) On the Use of Fumigation or Spraying.

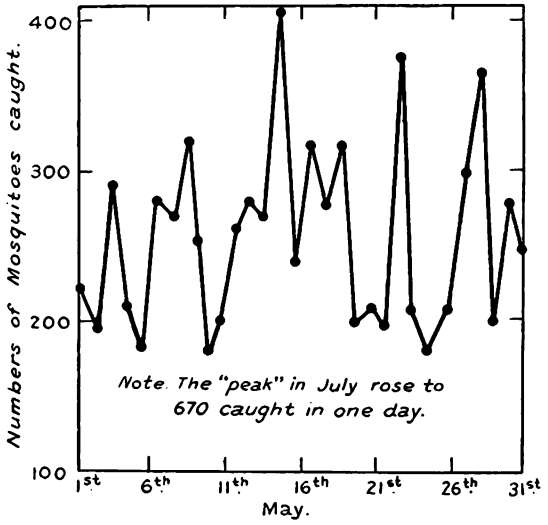
As mentioned previously, fumigation does not appear to lend itself to the production of great results, at any rate for the Indian type of barrack. The experience of many appears to be that, after much labour and

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expenditure of time, the results are extremely disappointing. One example from Jhansi may illustrate this.

A large British barrack was carefully treated at the end of the malaria season in the R.A. lines close to the dhobie nullah, the bugbear of the antimalaria officer. Expert R.E. assistance was obtained and the full quantities of fumigant were used. The deaths officially recorded were: wasps 1, moths 1, mosquitoes 0.

Richardson has shown recently that no permanent results can be expected, even with repeated systematic fumigation. Fumigated barracks were daily infested with fresh arrivals from neighbouring uncontrolled areas; the conclusion was reached that the effort was not worth the result.



Graph of daily catches.

Fumigation, although applicable to European conditions, such as have been emphasized by Colonel James, where definitely infected mosquitoes can be shown to hibernate in inhabited rooms, is not so effective in India where *stephensi* and *culicifacies* may and will repeatedly re-infest the fumigated rooms.

Spraying with lethal solutions, however, appears to be a much more useful method. The method is comparatively easy, except for the upper parts of large rooms; it can be done relatively cheaply and, above all, it is a method which appeals to the mind of the soldier and the company officer, and is therefore carried out regularly, particularly if paid for partly from unit funds.

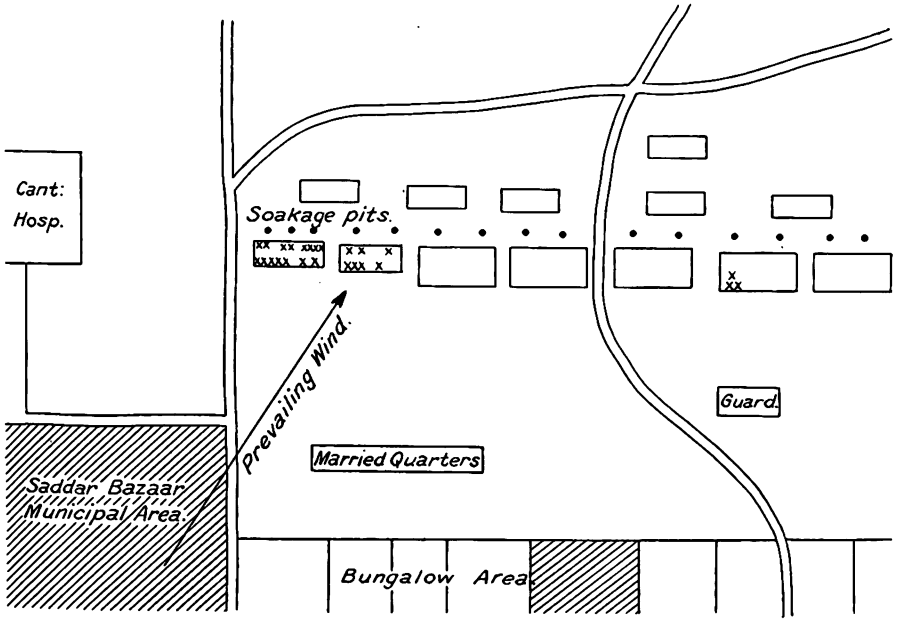
The proprietary spraying solutions, so freely advertised by means of alarming pictures, although very effective are also very expensive. What we require is a cheap and easily procurable home-made solution which will

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be reasonably effective. One such solution called "rids" was found to be very effective and not highly inflammable. This is composed of: kerosene oil 89·6 per cent, carbon tetrachloride 7 per cent, methyl salicylate 3·4 per cent; or a cheaper variety, kerosene oil 98 per cent, carbon tetrachloride 2 per cent. The ingredients can readily be purchased from any bazaar chemist.

Sprays of many kinds are available. Cheap and effective types can be obtained readily through the Planters' Association Stores, Calcutta. A very useful type can be got for about Rs. 4.

The soapy-hand method undoubtedly offers a very valuable alternative to spraying or fumigation. It is easily learned and can be carried out



Karachi. British troops barracks (purely diagrammatic).

by Indian troops; it proved most effective in the large station of Dehra Dun. It was described in the previous notes.

If inter-company competitions are carried out with a small monthly prize, the weekly "bags" and clearance of mosquitoes are amazing. The graph of daily catchings from the barrack rooms of one company shows the large numbers which may be caught by this method. In a certain dâk bungalow fifty-three mosquitoes were caught in three minutes by one of us.

The methods of spraying and soapy-hand are surely far too useful to discard, and should be used for barracks where mass protection by complete proofing has not yet been obtained. The graph of daily catchings at Dehra Dun may also be regarded as a very strong argument in favour of mosquito proofing of all barracks.

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(5) On the Use of Spot-Maps.

It is agreed that spot-maps, as generally understood, i.e., maps showing breeding places of mosquitoes and other such items of interest, are undoubtedly essential as a working basis for all antimosquito work. Such spot-maps are found in every average cantonment and *for* the cantonment. But they usually give only very sketchy details for the neighbouring non-cantonment land, which may well form the bulk of the breeding grounds.

But the spot-map to which we wish to draw particular attention is that recorded on a plan of the barracks showing the position of the bed occupied by every case of sickness. A collection of red crosses, or whatever sign is used to indicate malaria, in one part of a barrack-room shows that something is wrong and attention can be directed to ascertaining the cause.

(6) On Ignorance and Education.

In the previous series of notes cases of ignorance were quoted to show where antimalarial efforts might well fail from this ignorance in our very midst. Major Mansell considers that this will be gradually overcome in our cantonments, and even in the surrounding areas, by education of civilians.

Perhaps, like the millennium, such a time eventually will come, and the whole of our populations in and around cantonments will be sufficiently educated to carry out complete antibreeding methods. We very much doubt if we shall live to see that time.

In the meantime are we not, from this very ignorance, subject to mass mosquito breeding in our very midst? Can we be sure that the walled Mahomedan house, into which we may not enter, is not breeding mosquitoes freely in its courtyard, fountains or tanks? Can we be sure that the multitudinous staff of the C.M.A., who, by force of persistence and numbers, acquire many desirable bungalows in the midst of cantonments, are sufficiently educated to keep their bungalows free from mosquito breeding? Can we even be certain that the officer or his wife, the cavalry subaltern or the grass-farm manager are all sufficiently educated in this? We beg leave to doubt it, and therefore must admit that the potential danger remains or is likely to remain in our midst.

A further example may be of value.

An R.E. officer, Garrison Engineer to two malarious stations and responsible for the expenditure of several thousands of rupees of antimalaria funds, was attending a "backward boys' class" for promotion. In a test paper the question was put, "To describe under certain conditions what antimosquito measures should be carried out?"

The reply given was, "Burn all litter to prevent breeding of mosquitoes." However, there is no doubt that education is spreading, and evidence of knowledge in the subject crops up in astonishing places. At the village of

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Bageshwar, in the mountains two marches north of Almora, when fishing the Sarju, the fishing chokra, aged 14, was found to have a very fair knowledge of mosquito breeding, and why and how it should be stopped.

But to return to our cantonment; surely the prevailing ignorance amongst a considerable portion of the population makes it obvious that antibreeding methods can, at present, certainly not free our cantonment, and that therefore only mass protection is the true remedy.

(7) Conclusions.

The various points which have been considered indicate that our cantonments, as at present constituted, are not suited for the eradication of malaria by mosquito destruction, and that therefore we must fall back on protection, the individual protection of the mosquito net and the mass protection of the proofed barrack.

This is really a question of money, and where money is not available all the other methods certainly are of value and play their respective parts. That much success by these methods can be and should be gained is admitted, and is illustrated by the examples given. It is suggested, however, that every endeavour should be made to attain mass protection by a continuously progressive policy.

It is suggested that, in view of the nature of our cantonments, only a minimum amount of the annual grants should be utilized for the actual carrying on of the antibreeding and destruction methods. Such methods should include inexpensive means of filling or drainage on some proper plan; the controlled use of Paris green and oils; the use of co-ordinated spot-maps; the use of suitable inexpensive spraying solutions; the use of the soapy-hand method; and the enlistment of the help of all ranks in the station.

It is suggested that hard-won antimalaria funds should not be dissipated on drainage which will only remotely affect the situation, and the cost of which should be met from other sources such as building or cantonment grants.

Furthermore, as large a proportion of the available funds as possible should be carefully collected and expended on the attainment of mass protection by the proofing of all barracks, institutes and quarters where our valuable military population dwells.

It is not suggested that by this method we can hope to eliminate malaria entirely from our midst, but that under present conditions it does appear to be the most effective and readily attainable way by which we can hope or expect that malaria will cease to be the leading cause of sickness amongst our personnel.

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Editorial.

REPORT OF THE MEDICAL RESEARCH COUNCIL FOR THE YEAR 1928-29.

In the introduction to the Report the Council pay a tribute to Lord Balfour, who was appointed chairman of the Medical Research Council in 1924, and held this post until July, 1929, when failing health rendered him unable to continue active work in London. Soon after he became chairman of the Research Council, Lord Balfour re-entered the Government as Lord President of the Privy Council, and was entrusted with the duty of setting up the new machinery of the Committee of Civil Research. This new machinery brought great benefits to the Medical Research Council by bringing it into more effective relation with research work of other kinds and in other places, and aiding the passage of completed research work as such to its application in practical affairs.

The late Lord Justice Ronan made a bequest to the Council which enabled the new extension of the National Institute at Hampstead to be completed in 1929.

The National Institute is the centre of research work done in various branches of medical science by workers in the whole-time service of the Council. It also maintains and distributes the national standards for certain remedies, the activity of which can be measured only by biological methods, and so plays a part analogous to that of the National Physical Laboratory in the physical and engineering fields.

The creation of new standards and the preparation and verification of the national standards were in progress at the National Institute before there was a legislative demand for them, or opportunity for their official application.

When, therefore, the Therapeutic Substances Bill was enacted in 1925 the standard materials required for the effective use of its machinery were ready for issue.

The following national biological standards required by the law are maintained at the Institute: diphtheria antitoxin, tetanus antitoxin, anti-dysentery serum (Shiga), tuberculin, insulin, pituitary posterior lobe, arsenobenzene, novarsenobenzene and sulpharsenobenzene. All these are based on international standards, of which those for tuberculin and insulin were prepared at the Institute. The international standards now held there for maintenance and general distribution are those of insulin, sulpharsenobenzene, digitalis, and strophanthin.

In reviewing the work of the past five years the Council state that no part of the work promoted by them has greater biological interest or more practical importance for the cure and prevention of disease than the study of the filter-passing viruses. Whether these are organized as minute ultra-microscopic bodies is still an open question, but they are presumably

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too small to have an organization similar to that of cells which hitherto have been regarded as primary units of living matter.

An artificial fluid in which these viruses by themselves can multiply has not yet been prepared. It seems to be a characteristic of a virus that it can multiply only in the presence of living cells which it can infect.

Attempts have been made to produce immunity against the virus by treating it with chemical substances until it is incapable of reproducing the disease when injected into a susceptible animal. Twenty years ago Fermi, in Italy, employed rabies virus treated with carbolic acid to immunize against that disease, and apparently succeeded. At the Council's farm laboratories Dr. Laidlaw and Mr. Dunkin have used for the protection against distemper a virus made harmless by formalin. At the National Institute Dr. Todd has also shown that two or three inoculations of the virus of fowl plague which has been treated with carbolic acid and glycerine until it is no longer capable of giving the disease to a fowl, makes the bird so resistant to the disease that the injection of 300,000 times an otherwise fatal dose of infective virus has no harmful effect.

In the case of foot-and-mouth disease it has been found that immunity can be produced by a treated virus, but as the disease itself gives no lasting immunity this has no great value. But it might be used for checking a wave of invasion, had the disease been due to one virus only. Unfortunately, there appear to be three types of virus, and the effects of one do not protect against the others.

With regard to measles, it seems that the monkey is the only animal susceptible to the virus, and the disease cannot be passed from monkey to monkey. Influenza cannot be transmitted to animals, and human experiments on a large scale are not justifiable. In view of all these difficulties the Council are concentrating on every available method for the study of the actual nature of the virus particles in the hope that such knowledge may bring some gain in the control of virus disease.

In many diseases caused by bacteria the toxin of the invading microbe can be neutralized by the anti-toxin in the blood entering into some chemical combination with it.

Dr. Todd has shown that the virus of fowl plague can be rendered harmless by the addition of the right amount of immune body fluid. But the combination is so unstable that the addition of water renders the mixture again virulent.

Dr. Andrewes has also shown that from a non-infective mixture of virus and immune substance the virus can be obtained in a virulent form by simple filtration.

The distribution of the virus in the blood has been investigated and before the war the Council state that it was shown that the virus of typhus and rinderpest does not float freely like a bacterial invasion in the fluids of the blood but is wholly contained within the bodies of the white blood corpuscles. It was shown, however, first by Kusama and subsequently by

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Bacot and Ségal that the virus of typhus is contained in the blood platelets and not in the leucocytes. Last year Dr. Todd found the virus of fowl plague was contained in the white blood corpuscles and Dr. Laidlaw and Mr. Dunkin found the same relation in canine distemper. This year Dr. Wilson Smith has shown it to be true also for vaccinia; on the other hand, at the Lister Institute it has been found that the virus of foot-and-mouth disease is almost wholly, and for all periods, found free in the body fluids, and this has been confirmed by Mr. Galloway in the National Institute.

Although no fluid has yet been discovered in which the invading virus will multiply outside the human body, Dr. Andrewes has found a method of studying virus infection outside the body by infecting with virus small fragments of animal tissue which are kept surviving in suitable fluid media. Evidence of infection is seen by the presence of the so-called "inclusion bodies," which are found microscopically in the tissue cells and are exactly similar to the corresponding appearances which accompany infection of the living body by the same virus. Dr. Andrewes has shown that the virus known as Virus III, of rabbits, will multiply indefinitely in artificial cultures of this kind and will form "inclusion bodies" within the nuclei of the cells.

Five years ago as part of a research on virus diseases the Council arranged with Dr. Gye to take up the study of the Rous sarcoma in fowls. From time to time reports on his work appeared and last year the Council reported that Dr. Gye had been unable to obtain with regularity the results which had led him to a definite view of the mode in which a virus conveyed from a pre-existing malignant growth interacted with another factor in the invaded cell to produce a new tumour. In the past year Dr. Gye has endeavoured to find the cause of the discrepancies in his results but without success, and he has now turned to other aspects of the problem.

Dr. Todd has made some interesting observations on the "individuality" of animal cells which are of special interest in relation to skin grafting and the transplantation of other tissues in operative surgery. It is not known whether all cells of the body or only some of them are stamped with "individual" as well as with "specific" qualities. Auto-transplants in surgery succeed, while hetero-transplants, as when the skin is taken from another person, generally fail.

As regards clinical research and experimental medicine the Council point out that the larger part of their annual income is expended in grants to approved workers in nearly all the Universities and other centres of research throughout the country. Most of the work in the present report has been done in laboratories of physiology, biochemistry, bacteriology and pathology, while only a very small part has been done by men engaged in clinical work and studying disease as it actually occurs in human beings. The Council ask: Is there a science of experimental medicine of which the material for study is the human body? Or is the scientific work of

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the physician and surgeon limited to the application in his art of scientific results worked out elsewhere in the laboratory?

The work of a physician is quite different from that of a man engaged in the task of advancing knowledge. The main duty of a physician is to diagnose his case by studying the individual and then to apply appropriate treatment. In the work he makes use of the results of scientific research. The research worker in clinical medicine or surgery does not concentrate on the complex of the individual, but studies the disease process, ignoring individuality completely. Fifteen years ago the Council came to the conclusion that scientific work in clinical medicine could not make progress under the conditions obtaining in modern teaching hospitals. To perform research work the man must be freed from the cares of private practice, and having no teaching or clinical responsibilities, he can then concentrate on some particular clinical work. Embued with these ideas the Council in 1916 started the first hospital "unit" under the Sir Thomas Lewis at University College Hospital and they consider that there can be no doubt as to the value of the results of his work in the scientific study of the heart and blood vascular system. With these results in front of them the Council say now that there is undoubtedly a science of experimental medicine.

As a consequence of a memorandum presented by the Council to the Board of Education, the Government, in 1919, made financial provision for setting up University clinics on the "unit" system in certain selected hospitals in London. After ten years of work the Council consider that the time has come to determine in what degree the University units have contributed to progress in research as well as to progress in education. There is no doubt that in teaching they have done valuable work, but this has crippled their energies for research work. The units have not produced men able and willing to devote themselves to clinical research. The main cause of this is the absence of a stable position with reasonable remuneration. The Council state that there can never be a successful recruitment of young men of ability for clinical research until there are at least a few stable positions in sight, which at middle-age will provide reasonable remuneration and adequate power of educating a family.

The Council declare their intention to encourage still further the scientific and direct study of disease in man. They wish to recruit young men of ability and are prepared to help these recruits to the utmost of their power in a preliminary period of training and will increase the number of workers in the clinical field upon their permanent staff as soon as they are able to select candidates whose work has made the Council confident of their success in a career of research.

Having dealt with the main points in the Introduction to the Report we must make a brief reference to some important results which have been obtained in the departments of the National Institute for Medical Research. In the department of pharmacology and biochemistry very interesting

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studies have been made with acetylcholine mentioned in last year's Report as having been obtained from the spleens of large animals like the horse and the ox. The localized flushings and heat which accompany localized pain seem to be due to the liberation of this substance in very minute quantities near the end points of the nerves. This, taken in conjunction with the wide distribution of histamine in the body, points to a wide conception of the chemical machinery concerned in the adjustment of the circulation to the local physiological needs of the body.

Dr. King and Dr. Gough have discovered a new group of aromatic amides containing arsenic which have pronounced curative action in trypanosomiasis analogous to that of sleeping sickness.

In the department of applied physiology and hygiene Dr. Hill and Dr. Campbell have studied the effects on animals of prolonged exposure to high tensions of oxygen. The harmful effects of this exposure have been found to be associated with a poisonously high tension of carbon dioxide in the tissues. This appears to be due to constriction of the blood-vessels and to saturation of the blood with oxygen with a reduction in its power of carrying carbon dioxide. Animals can withstand prolonged exposure to high atmospheric pressures if the proportion of oxygen be suitably reduced. A pressure of ten atmospheres is well tolerated for a long period provided that the oxygen is reduced to 2 per cent in the mixture breathed, and that carbon dioxide is effectively removed. The long-continued excess of dissolved nitrogen in the blood and tissues appears to be harmless.

On the other hand the breathing of pure oxygen for a short period has been shown to accelerate the removal of the dissolved nitrogen after exposure to high pressure. Dr. Hill in a series of tests conducted for the Admiralty at Loch Long has shown that by this means the regulation times for decompression could be shortened by two-thirds and in one case by three-quarters. A record depth of 308 ft. was attained by two divers who had not previously been deeper than 120 ft.

Some sixty pages of the Report are devoted to a brief description of the researches now being carried out in clinical and other units. Statements of the nature of the researches and the names of the workers are given, but for actual details the papers by the various authors, a list of which is given at end of each Report, must be consulted. It would serve no useful purpose merely to give a list of the researches.

It is interesting to note that Professor H. B. Dixon and Dr. W. F. Higgins, working at Manchester for the Committee on Anæsthetics, have examined many cylinders of nitrous oxide made by different firms and purchased in the open market. Carbon monoxide was present in all the samples tested in amounts varying from 5 to 40 parts per million. Tests of nitrate used in the manufacture showed that it was of high purity, but that small fragments of wood from the barrels in which it was supplied became mixed with the charge and so adulterated the product. Gas made from ammonium nitrate carefully sieved from these fragments showed a great reduction in carbon monoxide.

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SOUVENIR OF HENRY HILL HICKMAN.

Centenary Exhibition, 1830-1930, at the Wellcome Historical Medical Museum.

Henry Hill Hickman, the English pioneer in anæsthesia, died on April 2, 1830, and the Wellcome Historical Medical Museum has published a souvenir which takes the form of a small volume in which documents relating to Hickman's work have been published in full detail.

Hickman was born at Lady Halton, near Bromfield, on January 27, 1800. He was admitted a member of the Royal College of Surgeons in 1820, and practised at Ludlow, Shifnall, and Tenbury. In 1824, he published his famous pamphlet entitled, "A Letter on Suspended Animation" containing experiments showing it may safely be employed during operations on animals with the view of ascertaining its probable utility in surgical operations on the human subject." The letter was addressed to T. A. Knight, of Downton Castle, Herefordshire, a member of the Royal Society, in the hope that the experiments might be laid before the Royal Society. Hickman produced asphyxia by means of carbon dioxide and under its influence operations on animals were performed without causing pain or hæmorrhage. Unfortunately he did not try nitrous oxide gas recommended in 1800 by Humphry Davy for destroying physical pain during surgical operations. There is no evidence that Hickman's work was considered by the Royal Society and his repeated failures to obtain recognition at home led him to proceed to Paris where he presented a memorial to King Charles X. He submitted a memorial to the Académie Royale de Médecine which was read by the secretary and a committee was appointed. But no report by this committee can be found and apparently the matter was not further considered. Baron Larrey, the Emperor Napoleon's Surgeon-General, was the only one to realize the importance of Hickman's work. French surgeons generally having received his researches coldly, Hickman returned to England where he died at the early age of 30 years.

Hickman primarily sought anæsthesia; he was not content with suspended animation as an adjuvant to surgery, for he wished to avoid all asphyxial complication and so prevent hæmorrhage. Loss of blood was one of the worst difficulties and dangers in those days.

The use of other anæsthetics was subsequently made known. In 1842, Crawford Long used ether for the extraction of a tooth; in 1844, Wells employed nitrous oxide for operations; and in 1846, Morton administered ether in the Massachusetts General Hospital; and in 1847, Sir Walter Lawrence at St. Bartholomew's and Sir James Simpson in Edinburgh used chloroform for human beings.

The credit of first suggesting anæsthesia for surgical operations must,

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however, belong to Humphry Davy and Henry Hill Hickman. Hickman was the first to attack the problem of anæsthesia by the experimental method on animals. In 1847, Dr. Thomas Dudley, of Kingswinford, having obtained Hickman's pamphlet from Mrs. Hickman, wrote a letter to the *Lancet* claiming priority for Hickman's idea of establishing anæsthesia during surgical operations in the hope that justice might be done and credit awarded to him. In spite of Dr. Dudley's disinterested efforts nothing further was done and the claims of Hickman escaped attention until Mr. Henry S. Wellcome organized his Historical Medical Exhibition in 1913. He obtained documents from the official archives in Paris and from members of Hickman's family and this material has been added to the Wellcome Museum.

On April 2, 1930, just a hundred years after Hickman's death, Mr. Wellcome gave a reception to the Section of Anæsthetics of the Royal Society of Medicine, when an address on Hickman's work was given by Lord Dawson of Penn.

On April 5, a brass tablet, a centenary tribute to Hickman was unveiled by Sir StClair Thomson in Bromfield Parish Church.

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Clinical and other Notes.

A SURGICAL EMERGENCY BY AIR.

By Major A. G. WELLS, D.S.O.,
Royal Army Medical Corps.

Even in the present day of long-distance flights, giant airships and so forth, the transport of a case of acute abdomen by aeroplane for operation is an event so rare and having such far-reaching possibilities that a description of it is well worth while.

One morning about 12.30 p.m. I received a message from District Headquarters that I was required to proceed by air forthwith to Fort Sandeman to operate on a case of acute appendicitis. Failing my being able to go, air transport for the case was asked for to bring him in to Quetta. As it happened I was awaiting the arrival at hospital of an officer who was being brought in with a fractured thigh from a hunting accident and so could not leave. Application was made to the Royal Air Force, and at 1.30 p.m. Flying Officer Hughes set off in a British Fighter aeroplane carrying a Neil Robertson stretcher and accompanied by another plane as escort. The distance from Quetta to Port Sandeman by air is roughly 200 miles, and owing to the high mountains which have to be crossed is by no means a comfortable journey. Fort Sandeman was reached at about 4 p.m., and after refilling with petrol and loading up the patient, who was ready waiting at the aerodrome, the return journey was commenced at 5 p.m. At this time of year it is dark at 6.30 p.m., but fortunately there was a rising full moon, although I understand that without the moon the journey would still have been made. The Quetta aerodrome was reached at 7.30 p.m. and a perfect landing without a bump made with the aid of flares. The patient, who was a young Indian soldier, arrived in perfect condition, he was quite warm and not in the least frightened or put out.

He was placed in a waiting ambulance and conveyed to the Indian Military Hospital where I operated upon him at once, to find a gangrenous retrocæcal appendix which would certainly have perforated in another few hours. He has made an uneventful recovery from the operation, and curiously enough did not seem to look upon his experience as anything much out of the ordinary.

The actual time which elapsed between the departure of the plane to fetch the case and the patient's arrival in hospital at 8 p.m. was only six and a half hours. Had I flown to Fort Sandeman I could not have operated upon him until 4.30 p.m. at the earliest, only three and a half hours before I actually did so, this small delay not making any difference to the ultimate result, but what I consider of far greater importance, and an advantage that far outweighs the three and half hours delay, is the fact that had I gone up there I should have had to operate under most adverse conditions, and the after-nursing treatment would have devolved on

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FIG. 1.—Apparatus open.



FIG. 2.—Apparatus applied.

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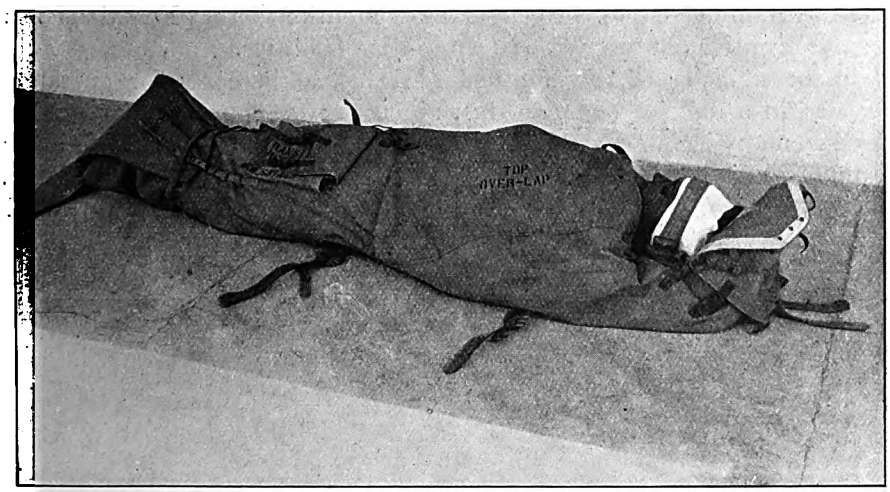


FIG. 3.—Apparatus closed.

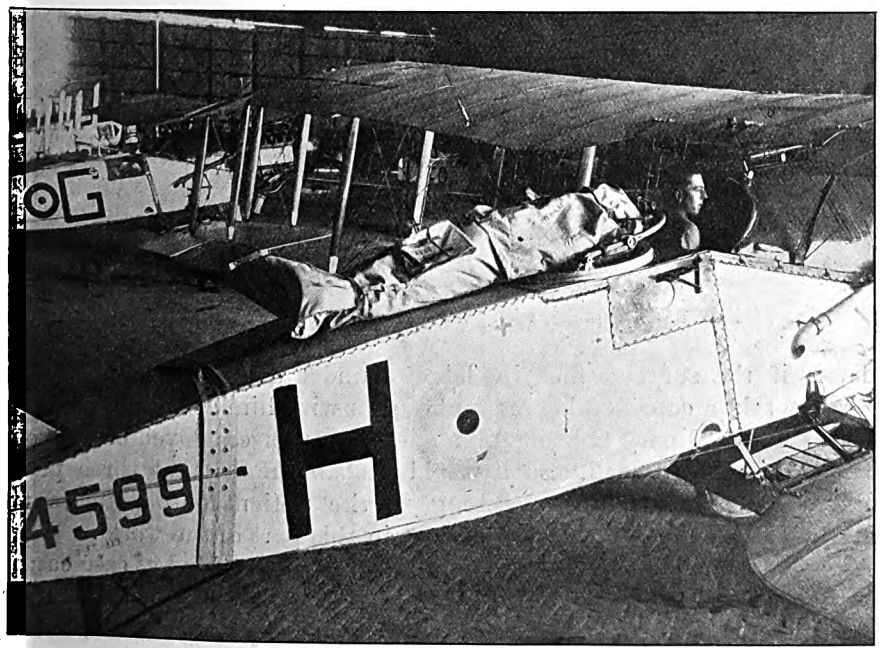


FIG. 4.—Patient on plane.

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unskilled attendants, whereas by bringing him in to Quetta one had all the advantages of a first-class operating theatre with skilled after-treatment by trained nursing sisters. I should have mentioned that Fort Sandeman is a small frontier outpost with no up-to-date facilities.

The possibilities of this method of bringing in cases for operation, especially in a district such as this, appear to be enormous. The Zhob valley has many isolated stations where operations cannot be undertaken, and in order to reach them long motor journeys are called for with a resulting waste of time, and which in the winter are sometimes impossible owing to the roads being blocked by snow.

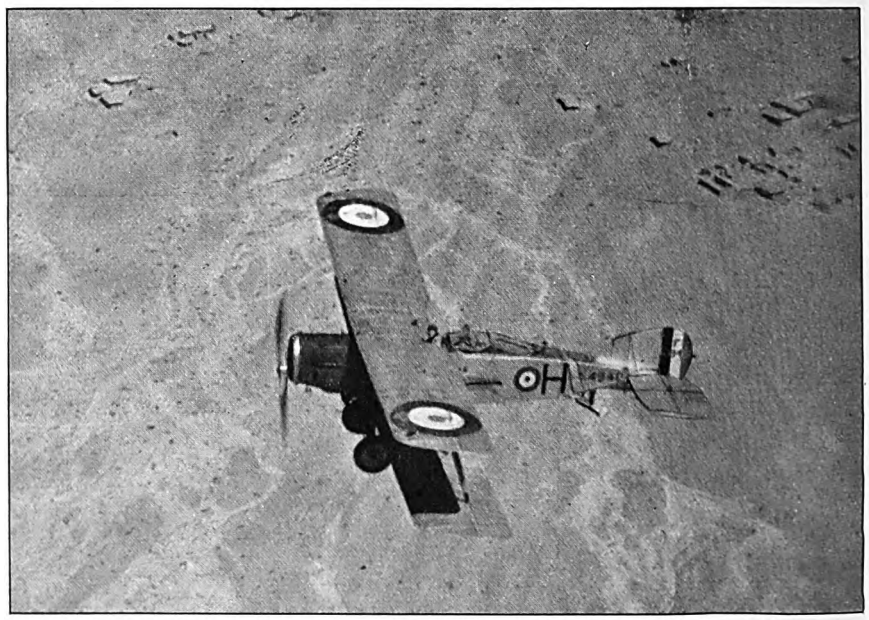


FIG. 5.—Aeroplane, with patient, in flight over Baluchistan.

Even if the surgeon flies he labours under great disadvantages and requires to take a considerable amount of gear with him as well as a theatre orderly. The ordinary fighting plane such as was employed on this case will not take a great load, and it would probably mean that three planes would be required, whereas fetching in the patient only requires two planes, one always having to go as escort in this part of the world.

At the same time it must be remembered that every kind of case cannot be carried on these stretchers, the unsuitable ones being head and spine cases, although with skilful landing I do not see why there should be any exceptions.

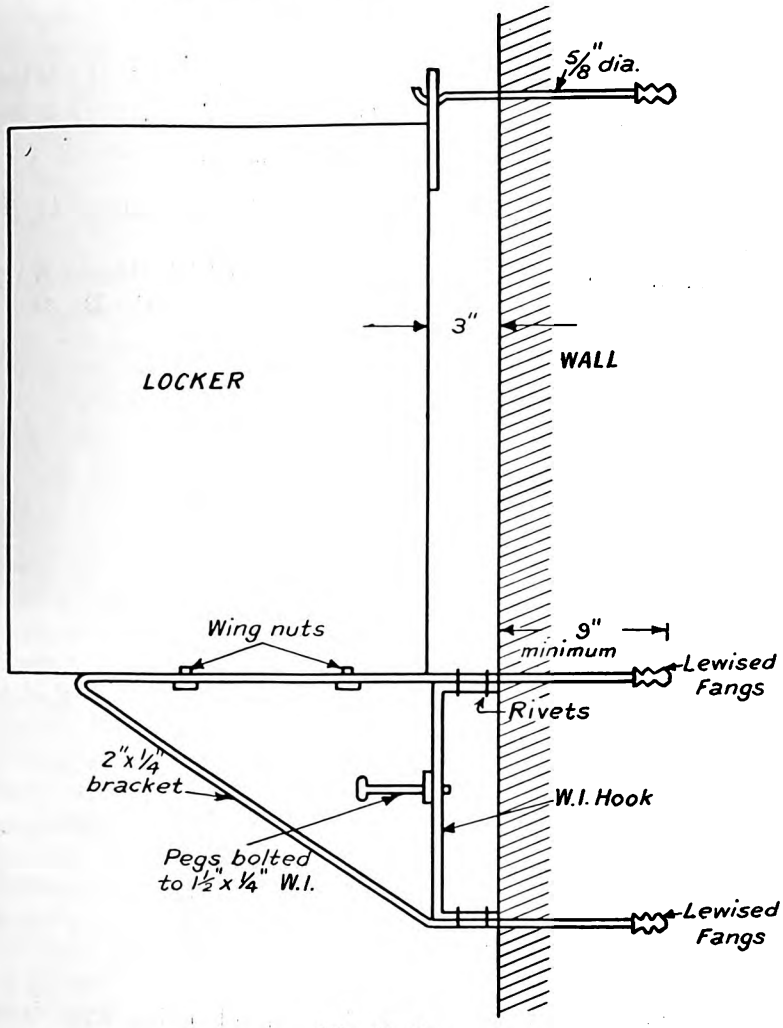
The photographs, for which I am indebted to Flight Lieutenant Cross, R.A.F., M.S., show clearly how the stretcher is used, and one actually shows the aeroplane in flight over Baluchistan.

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A METHOD FOR SECURING SOLDIERS' LOCKERS TO THE WALL.

By Lieutenant-Colonel W. W. BROWNE, O.B.E.,
Royal Army Medical Corps.

Wood tends to warp and shrink under tropical conditions. Cracks and crevices formed in the plaster around plugs driven into the walls provide excellent hiding places for bugs. With the introduction of the new pattern of equipment locker it was felt that an opportunity had occurred to improve the method of fixing them to the walls.



Side elevation.

Note.—Care must be taken in construction that the fitting of the iron hook is such that the crevices in which bugs can lodge are reduced to a minimum.

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The method shown in the accompanying diagram was devised by Colonel B. W. Y. Danford, D.S.O., Chief Engineer, the British Troops in Egypt, by whose courtesy it is reproduced.

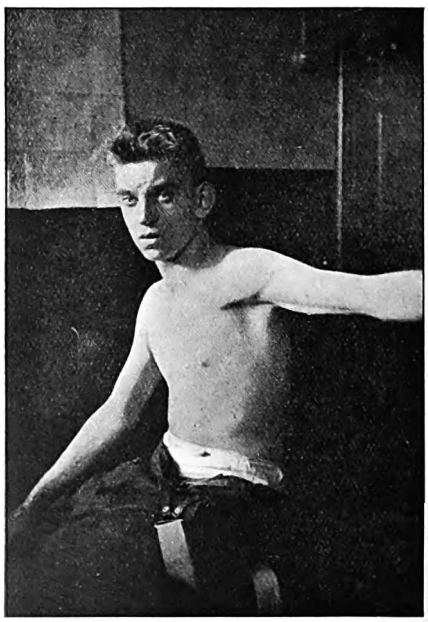
The advantages over the ordinary method of fixing the steel locker are: (*a*) the minimum amount of the fixture is in contact with the wall; the space between the locker and the wall enables daily dusting to be carried out, and the locker itself can be removed bodily for cleaning by unscrewing the wing nuts at the bottom; (*b*) extra support is given at the top. Fixing the locker by the underneath bracket only has proved unsatisfactory owing to the leverage. If any pressure is exerted at the top the surface of the wall round the supports breaks away and the cracks so formed become excellent hiding places for bugs.

ABSENCE OF THE LEFT PECTORALIS MAJOR MUSCLE, PROBABLY CONGENITAL.

By L. F. RICHMOND, M.D., B.S.

The following case is, I think, sufficiently uncommon to deserve recording.

Private T.S., aged 18, a recruit in the Durham Light Infantry, reported at the reception station for re-examination on arrival at the Depot.



On undressing it was at once noticed that the left side of the chest was very much flatter than the right and the left nipple and areola were smaller and less developed than those on the opposite side.

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On further investigation this flatness was found to be due to a complete absence of the sternal fibres of the left pectoralis major muscle. The clavicular head was present and more developed than its fellow on the right.

Miss Nicholson, Principal of the massage department at the Royal Victoria Infirmary, Newcastle-on-Tyne, very kindly tested his electrical reactions for me, but no response could be obtained either with the faradic or galvanic currents.

The condition would appear to be congenital in origin, as his mother gives me a history of a perfectly normal and natural delivery, so that any questions of a birth injury such as Erb's paralysis is improbable, while no history suggestive of an anterior poliomyelitis is obtainable.

The man has now two months' service and has been able to carry out his gymnasium work quite satisfactorily.

I am indebted to Major J. J. D. Roche, R.A.M.C., officer in charge, for permission to publish this case.

Echoes of the Past.

HONG KONG.

A Collection of Fragments, Literary, Statistical and Historical with Special Reference to 1845 and 1865.

By Major W. K. MORRISON, D.S.O.,
Royal Army Medical Corps.

(*Continued from p.* 395).

With reference to the occurrence of fever, it is of interest to record that there were forty-seven deaths from remittent fever in 1860, while in 1873 the Colonial Surgeon in his annual report "strongly animadverts on the increasing prevalence of continued fevers of a grave type, which he attributes to the defective drainage, but the subject has not yet received the attention it deserves."

Intemperance played a certain part in the causation of disease, and the "consumption of ardent spirits" was readily accepted by some as the primary cause of much of the sickness. "Sailors and strangers were those who suffered the most, because they had a jollification to celebrate their arrival and were next day dead and buried."

In the annual return for 1845, there are six cases of delirium tremens with one death, while only thirteen cases of "ebrietas" with no deaths are recorded. Yet in 1861 the number of cases admitted to hospital for "ebriositas" is 172. One witness stated how an urgent call was received from Stanley Barracks for sudden illness, but on arrival there twenty-three

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men were found lying in a state of intoxication. While another records that he saw through his glass men bathing at noon-day in the middle of the hot weather, and alternately drinking sham-shui which they had purchased from the occupants of a sampan near by.

A classical education is supposed to be a particular advantage in the medical profession, but such nearly failed to come to the rescue in explaining the unusual disease of punitus—twenty-four cases in Hong Kong, 1845. Corporal punishment must have been a terrible affair in those days, and let those who doubt that the number of lashes were given in hundreds, turn to the appendices of the Parliamentary Report. It is recorded there of one man that he was awarded 125 lashes. An asterisk indicates a foot-note, where it is recorded that he only received twenty-five lashes, as the surgeon intervened. Other men have the award of lashes in hundreds, but no asterisk indicates that they received other than the full amount. From the Army Medical Reports perused, it is obvious that all the men who received corporal punishment were carried to hospital afterwards. In 1865 it is recommended at Victoria Gaol, that a better form of whipping-post should be adopted to stretch the back, so that the strokes can be applied with more regularity. It is suggested that, in the case of more than two floggings being ordered for the same individual within six months, the intermediate one should be given on the buttocks. The object of this is to meet the difficulty of getting the skin sufficiently healed within two months so as to bear a second flogging. The appendices in the report also show a small number of men to be branded "D" "B.C."

But the prisoners of the regiment, if they escaped corporal punishment, were often doubly fortunate, as it is recorded that the healthiest men in the regiments were the prisoners because they had no night duty to perform, and had every night in bed and so no night-exposure to the miasmatic poison. The question of the origin of the miasmatic poison gave rise to all sorts of speculation, and for many years the most popular belief was that it came from disintegrated granite. The Colonial Surgeon of Hong Kong in 1848 stated: "The idea of this fearful epidemic (Hong Kong fever) being the product of malaria from 'decomposing granite' is founded on an ignorance of both Chemistry and Geology." In 1875, it is written that "the improved health in Hong Kong is due to the precautions taken to avoid as far as possible disturbing the earth in the vicinity of barracks." In 1893, two officers, one whose obituary notice was just recently in the Gazette (Colonel F. E. Barrow) and Colonel H. E. Paterson, stated most definitely that disintegrated granite, *per se*, had no connection whatever with malarious fevers. Yet the frailty of the medical profession is such, that even in the following year a new medical officer has no hesitation in proclaiming, in no uncertain voice, his firm conviction that disintegrated granite is the cause of Hong Kong fever.

Even in 1929, I have met one of the gentler sex, who had herself suffered from fever due to the ill-effects of imported disintegrated granite!

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Dr. Snell states : "In Hong Kong (1864) there is some peculiarity of the soil, which is a red yellowish clay, intermixed with disintegrated granite, and which, even when undisturbed, contains and gives off the miasmatic poison of ordinary intermittent fever : and when disturbed gives rise to remittent fever of a low typhoid type, highly and rapidly fatal in results, which type of fever proved so notoriously fatal in the early days of the settlement. The site of Victoria is now built over, and the fever is exceedingly uncommon. The virgin soil is covered by houses, roads, gardens and well planted with trees." "The town now (1866) is a healthier town than most of the others in the eastern tropics. But outside the town, wherever there are cuttings and excavations for new bungalows going on, such provide a fruitful source of fever."

The same idea gave rise also to the opinion that a large amount of sickness at Stanley and elsewhere was due to the fact that the parade grounds were not constructed until the barracks had been occupied. The troops were, therefore, exposed in the early days of their residence to the noxious effect of the turned-over soil.

Such was the opinion held for a long time, and when the question of permanent barracks for Kowloon was first discussed plans were issued for the construction of a "trial hut" : the hut to be built, and left unoccupied for a period, to get rid of the poison of the disintegrated granite. These plans did not bear fruit until 1866, as there was difficulty about the site and also about the final outlay of the permanent barracks.

One shrewd witness, in the subsequent inquiry, gave it as his considered opinion that just as much information would have been obtained by erecting the trial hut in Hyde Park!

In 1860 the question of the Appropriation of Kowloon, the peninsula of the mainland to the north of Hong Kong Island, is entered into fully in a War Office memorandum, written by the Secretary of War.

The following is an extract : "The necessity for increased accommodation for the garrison has long been apparent to the military authorities, and the acquisition of a healthy site like that of Kowloon points at once in which direction this accommodation must be found. The annual cost of life in the garrison, and the invaliding home of the sick are so costly, that, putting all questions of humanity aside, it is well worth the while of the Government, in an economical point of view, to go to considerable expense in constructing new barracks and hospitals open to the sea breezes."

Kowloon was handed over to the British on March 28, 1861. On December 31, the Principal Medical Officer in his Annual Sanitary Report to the Army Medical Department states : "The sanitary condition of the promontory of Kowloon is far from being good ; the vicinity of the huts (bamboo and 'Manilla') on the north side of the camp is especially objectionable ; the whole promontory is more or less surrounded and intersected in an irregular manner, by belts of paddy cultivation requiring constant irrigation. I strongly recommend that the cultivation be entirely

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interdicted." Kowloon now comes well into the picture, and one has not to study it far before one realizes that Kowloon was just as unhealthy as Stanley.

The first point to notice is the very definite statement: "In Kowloon before any cuttings and excavations were started, men of the 99th Regiment in 1864, after only a short residence there, used to get similar peculiar fever to that of the original Hong Kong fever. The detachment proceeding there became sickly in about a month to six weeks. Those who remained in Hong Kong did not get the fever, whilst those who went, even for a short musketry practice, did."

When the troops were gathering for the China War of 1860 some were encamped in Hong Kong, one camp being on the foreshore at Deep Water Bay, while others encamped at Kowloon. Many of the latter, including the 1st Battalion of the 2nd Regiment, picked up there the seeds of disease, which did not produce fever until they were on service in North China.

Such fever was, therefore, "due to the miasmatic poison of undisturbed granite."

In the 99th Regiment it was noted that there was an immunity from fever of all men who were not liable for night duty.

About August 9, 1864, excavations and cuttings were begun for the general levelling and laying out of the new settlement, civil and military, the future modern Kowloon. These cuttings were responsible for a fresh outbreak of Hong Kong fever, in an epidemic form, such as had not been known for some years.

On September 12, 1864, Private Howgill of the 99th Regiment was done to death in Victoria, in a street disturbance. He had the misfortune to receive an abdominal wound from a Malay kris in a brawl with Malay sailors.

The next evening unfortunate reprisals occurred which resulted in the confinement of the regiment to barracks on the 14th. On that evening one can picture the groups of men behind the wooden railings that separated them from the main road. Suddenly a mob of sailors appeared, armed with cutlasses. Brandishing these they harangued the soldiers behind the fence. "Come out, if ye are men, and avenge your dead comrade." A number of men, answering the challenge, leapt the fence and and were soon in full cry down the Praya. Unfortunately, one of the hunted, losing his nerve, jumped into a sampan, overbalanced, fell into the harbour and was drowned.

The night's work was to cost the regiment dearly. The next day orders were issued for it to quit Hong Kong, at three and a half hours' notice, and to proceed into the old huts at Kowloon. Strong protests by the commanding officer and surgeon of the regiment were without avail.

The admission rates for fever in this regiment were in September 68, October 203, November 288, and December 263, with a total of five deaths. The fever, according to Dr. Snell, was identical with the fatal and

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malarious Hong Kong fever. "The prophylactic effects of the quinine were completely neutralized by the fever-producing influences of the locality."

Only ninety-one men out of 568, stationed at Kowloon from October 1, 1864, to January 23, 1865, had not been attacked with some miasmatic disease during that period.

It is an interesting fact that the Annual Report of the Army Medical Department for 1865 records the subsequent effect of this malarious outbreak in the increased figures of admissions for miasmatic disease at the Cape of Good Hope, whither the 99th Regiment proceeded, as will appear shortly, and also the increase in the same figures in the returns for Her Majesty's troopships at sea.

In the beginning of February, 1865, the 2nd/9th (The Norfolk) Regiment arrived in Hong Kong harbour on board Her Majesty's screw troopship "Tamar," and relieved the 99th, who embarked for the Cape of Good Hope.

On the journey to the Cape ninety-nine admissions are shown for miasmatic diseases. Their arrival is recorded by Colonel Jenner, commanding the 2nd/11th (The Devonshire) Regiment, in a most moving account.

"When the 99th Regiment arrived at the Cape they were so decrepit that they could not march to their camp. The roads were strewn with men trying to march up with their band. The whole road was strewed with men and discarded packs. Out of 250 (who disembarked at this port), not more than 45 got to the camp without assistance. The camp was two miles away through sandy soil."

One can imagine what thoughts Colonel Jenner must have had as he realized that he was under orders to take his own regiment to the place that had reduced the 99th to such a plight. His misgivings would have been greater had he known that Dr. Dick, the P.M.O. at Hong Kong, had already written to superior authority in the following terms:—

"I very much fear that, if a second regiment is sent to Hong Kong before proper provision is made for its reception, the measure will defeat its own object, and that should a force be required for any emergency, after a residence of one hot season in the Colony, one of the regiments will be totally inefficient as regards any active military service; and that, should Hong Kong be visited by another unhealthy season, the risk of very serious mortality amongst the troops will be greatly aggravated by the impossibility of adopting any efficient sanitary measures. I need scarcely refer to the alternative of hired buildings for the occupation of troops, because suitable ones could not, I believe, be obtained at any cost. I would beg for the delay, if possible, of the despatch of a second English regiment to Hong Kong until proper accommodation be provided for it."

This request for delay was ineffectual and by an unfortunate coincidence Her Majesty's screw troopship "Tamar" made a record run, from the Cape to Hong Kong in forty-nine days, with the second English regiment on

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board, the 2nd/11th Foot, bringing the regiment at least one month before it was expected. Difficult though it had been before, the accommodation question became impossible of satisfactory solution.

What a plight for Colonel Jenner, when he received orders to disembark his headquarters wing to occupy the huts recently vacated by the 99th!

He protested and was joined in his protests by Captain Stirling, the Commander of the "Tamar," who told him that to go to Kowloon was to go to certain death. "If you go there, your regiment will be dead in a month." But he had no option. He had not long to wait before his worst fears were realized. At the same time too, he saw part of his regiment off to Stanley, of evil reputation, and saw also others of his men housed in go-downs, where they had to cook out in the glare of the summer sun without cover and without topees, and for other purposes had to adjourn to the bush adjoining. On June 30, 1865, thirty-one days after his warning from the Commander of H.M.S. "Tamar," a typhoon struck the Island. "After it was over I had to go to Kowloon in the evening. There should have been 240 to 250 men on parade at 5.30 p.m. When I got there only thirty-six paraded and before the roll could be called twenty of these had fallen out. I dismissed the remainder and ordered the roll to be called by companies. I went to look for the men myself, and found them lying in the church or chapel as they call it. I do not know how to describe it, they were lying on the floor covered over with blankets and greatcoats in a state of fever and ague." Later he says: "I have seen them go down 120 on parade at a time. They had very excessive night duties to perform, and I told the adjutant, that, if he put a man on guard with only one night in bed, I would place him under arrest. Wear accoutrements? The men of the regiment could not wear their belts, their spleens were so bad. They never wore accoutrements for four or five months. Eight or ten families were sent to live at Kowloon and the children began to die at the rate of three or four a day."

Colonel Sankey, commanding the 2nd/9th Regiment had a similar tale. "I had a guard of 110 men over at Kowloon for a fortnight, and when they returned to Hong Kong nearly all had to go to hospital with fever. Cuttings were going on to an enormous extent, and some of the officers' huts were actually taken away by the cuttings. Every person, who had experience, said, 'of course we shall have more sickness while the cuttings are going on.' The cuttings were for the site of a new town at Kowloon. Several acres of ground were levelled and the stuff was thrown down to erect wharves and piers. No punkahs were allowed at Kowloon, owing to the supposition that it was much cooler from the effect of the monsoon. The men of the battalion could not sleep on account of the mosquitoes. The wind of the punkahs would have kept them away. Instead many of the men used to go out and sleep in the long grass round the barracks to get away from the bites of the mosquitoes. I was speaking to the Captain of H.M.S. 'Cormorant' the other day, and he told me that in Hong

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Kong, in 1865, he lost eighteen men by death out of seventy-two, and the health of the remainder was such, that he could not put out to sea." These two unfortunate regiments, the 2nd/9th and the 2nd/11th, suffered very heavily. From June 1 to October 20, 1865, the former, with an average strength of 839 men had 1,354 admissions with 29 deaths, whilst in addition there died 6 women and 24 children ; the latter regiment with a strength of 704 had 1,261 admissions with 43 deaths, in addition there died 3 women and 48 children.

The total deaths from paroxysmal fever in 1865 for these regiments was twelve in the 2nd/9th and thirty-three in the 2nd/11th. In this year there stands out the firm and unflinching attitude of George Saunders, Surgeon, 2nd Bn. 9th Regiment. He was acting principal medical officer, and there is many a word of praise for him in the evidence.

On August 24, 1865, he asked for transport for his many invalids to England, but on August 31 found that his application had been forwarded by the acting local commandant to the General Officer Commanding, who was absent on inspection duty in Japan.

He therefore writes : "The consequent delay (one month) ere a reply can be received is a most solemn responsibility ; many of these men will have perished, whose lives might otherwise have been saved. There are women and children also, who would succumb to this climate, whose lives might be preserved by immediate removal. You will, I trust, bear with me in making these remarks, as I am solely moved by a deep sense of duty and the cause of humanity."

The reply is couched in curious language: "Instructions have been given to supply the transport you require. I have to add that your statement is so forcible and rendered in so humane a spirit, that I congratulate myself upon its receipt, as it enables us to anticipate his Excellency the Major-General's instructions on this subject."

There is something particularly sad about the fate of those unfortunate invalids who never lived to see their native shores again. One can see the ship well under way, Hong Kong fading in the distance, and yet out of 254 invalids in 1865, sixty-six died on the journey home !

It is recorded of one ship with invalids from Hong Kong, how shortly after they had sailed, the officer in charge of invalids heard for the first time that he had ninety tons of gunpowder on board as cargo. He organized what fire-picquets he could from the invalids, but they were small in numbers and of miserable physique, yet he had the pleasure of extinguishing two fires with their help on the way home.

Thus have we seen now that by invalidism and death was the forecast of Dr. Dick, P.M.O., fulfilled.

But he had not long to wait before he was called upon for his explanations. The Major-General had gone off on inspection tour. Dr. Dick, waiting until he was satisfied that all that could be done in the way of accommodation, under existing local conditions, had been accomplished,

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left his office in the care of the able Dr. Saunders and proceeded after his General to Japan. Three letters from the authorities at home, written at the end of 1865, reached him and asked practically the same question: "Explain why you were absent from Hong Kong during the sickly season, and at a time when there is such an amount of sickness amongst the troops, and are at a station, where the climate is so good, the force so small and healthy, and for whose care the regimental officers are quite sufficient. His lordship will reserve his judgment until he is in possession of a full report from you on the whole case."

It was not until March 26, 1866, that it occurred to those at home to follow up these first letters with one addressed to the Major-General Commanding himself.

"It is regretted that the previous letters did not more distinctly call for an explanation of the conduct of other officers besides the medical officers."

Dr. Dick's reply was thus: "I went on my annual tour of inspections of the 67th (The Hampshire) Regiment and the 20th Regiment, the former at Shanghai and the latter at Yokohama. At the latter station, the headquarters of the command had been established before my arrival. I would myself have accompanied the General and his staff had the business of my office permitted it, as I have always understood, that the proper station of the principal medical officer is the headquarters of the command, wherever it may be, and in taxing my recollections to the very utmost, I can remember no case where it has been otherwise (and I never had the least shadow of a doubt on the subject until the receipt of your letter), but as soon as I was made aware of the sickness among the garrison at Hong Kong I lost no time in returning to that station. The causes of the sickness, past and present, are another question, but I venture to say, and I say advisedly, that they could not have been effectually controlled at any period, after the arrival of the 2nd Battn. 11th Regiment, by any local medical authority, even though he had been armed with full power to act as he thought necessary in the promotion of sanitary measures."

Subsequently he wrote on February 9, 1866: "Since my arrival here, almost four months ago, I have been engaged in the active discharge of my duty, and that the garrison has continued very sickly almost up to the present time."

In his evidence, the principal medical officer refers to the alleged shortage of medical officers. The medical officers were worked hard, and after the death of Assistant Surgeon Macintyre, Dr. Piper, the assistant surgeon of the 2nd/9th, had to look after the 2nd/11th as well. Two other medical officers were on the sick list, but at no time, Dr. Dick states, was there any anxiety about the number of medical officers available, owing to the willing co-operation of the medical services of the Senior Service who were always willing to come forward and help in emergency, should such have occurred.

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It is interesting to record that one of the attempts to improve the health of the garrison was the provision of a sanatorium at a height of 1,670 feet on Victoria Peak. This was very shortly afterwards closed down, owing to the continual occurrence of dysentery amongst the soldiers transferred to it for convalescence. The dysentery, which was due presumably to some carrier among the staff, was at the time attributed to the altitude. After this, as far as possible, certain detachments were sent north, but the accommodation in Yokohama was limited. Yet later, in 1878, it is recorded that Singapore was used as a convalescent station for Hong Kong! In that year the 28th (The Gloucestershire) Regiment had suffered so much from paroxysmal fever contracted at Kowloon, that they were sent to Singapore, where they threw off completely the susceptibility to the disease.

The causes of the excessive prevalence of paroxysmal fevers in 1865 were held to be: the cuttings and excavations and exposure of fresh soil; the state of the bamboo and "Manilla" huts at Kowloon; defective barrack accommodation aggravated by overcrowding; excessive night duty; and the withdrawal of Asiatic troops. This last involved an increase in the duties of the European troops, and a much greater amount of exposure to the influence of the heat. After the Parliamentary Inquiry in 1866, the reposting of Asiatic troops was decided on with the intent of relieving the British troops of as much duty as possible. In this connection, it is well to bear in mind that even nowadays the hot weather in Hong Kong is very trying, particularly for men on exposed duties.

Musketry practices appear so frequently in the records as a cause of an increase of paroxysmal fevers, that it is worth while to review the records of such. We have noted that in 1864, Dr. Snell stated that those who went to Kowloon, even only for a short musketry course, contracted the fever, and that too before the commencement of the cuttings. In 1877 it is reported "A marked change in the sanitary condition of Kowloon for the past year has been noted. It is customary for the infantry regiments at Hong Kong to proceed by companies to the promontory every year, during the cool season, for musketry practice, being encamped in ordinary bell tents. In previous years the men benefited much by the change, but soon after the course commenced last season malarious fevers broke out amongst the men.

"After careful inspection of the vicinity of the camp, it was found that the diseases were caused by the disturbance of the soil by civilians who owned and cultivated plots of land around the military reservation. On inquiry, it was ascertained that the civilian families, residing at Kowloon, suffered to a great extent from these fevers; and that some of their native servants had died from the same causes.

"It was therefore recommended to the officer commanding the troops, that the men should be withdrawn and the musketry course suspended. This measure was adopted and the fevers declined in number after the return of the men to the garrison. Many of the diseases, however, which

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had undoubtedly been contracted at Kowloon, developed themselves after the men had been withdrawn from the mainland."

Again in the following year, 1878, it is reported: "At Kowloon, where the annual course of rifle practice takes place, and where the troops are usually encamped, malarious fevers are prevalent. The Deputy Surgeon-General recommended in consequence, that the men should be taken over and brought back daily in steam launches; this has been carried out and the result has been most satisfactory."

In 1928, a musketry practice camp was held at Chukon, Kowloon, but had to be abandoned on account of the prevalence of malaria amongst the men. The hospital accommodation was taxed to the utmost. Thus does history repeat itself.

The first military hospital in Hong Kong was presumably one of the bamboo huts at West Point. Certain it is, that all the huts at West Point, on July 21, 1841, were badly damaged by a severe typhoon. "Barrack" after "barrack" was laid flat by the violence of the storm. From the description of the event, one can imagine the plight of the unfortunate soldiers, as they collected their effects and repaired the damage of the wind and rain. But after four days, on the night of July 25-26, a second typhoon swept over the camp and demolished even the minor works they had restored! One wonders how often Hong Kong has been thus afflicted by two consecutive typhoons? Such a double event must bring despair to the chief engineer but delight to the heart of the contractor!

Prophylactic quinine has been in use in Hong Kong for many years. In 1864, the quinine cost 10s. 6d. an ounce. Those who lived in Hong Kong were given two grains daily, whilst those stationed in Kowloon received four grains daily. The quinine, originally, was given in porter, and its popularity as an issue disappeared when water was substituted. There were so many complaints, that a little rum was added to the water, when the quinine once again became popular; finally, however, water was the sole solvent. In 1887 it is recorded that quinine prophylaxis failed to keep down the paroxysmal fevers.

In 1843 the house on Marine lot No. 46 was occupied as a military hospital at a rental of 300 dollars a month. One would have liked time to identify this place and, should it have appeared convenient, to indicate the spot with a small plate. In Dr. Kinnis's report he refers to Gillespie Barracks, a hired house on the sea-front, at the east end of the town, which was formerly a European military hospital. By 1843 there was a military hospital at Stanley, which was really a converted barrack of two stories high. It was situated six feet above the parade ground and had a northern aspect seventy-one feet above sea-level. The bedsteads were of wood with cane bottoms and "betwixt them small movable medicine stands." There was accommodation here for seventy-six patients, but at the time of the doctor's visit he found 106 patients in hospital out of a strength of 377 men of the 18th regiment. The military hospital proper

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was on the north side of the Queen's Road, a little way to the east of the North Barracks. The foundation was laid on November 3, 1844, and the building occupied on February 13, 1846. "The hospital is separated from the North Barracks by the Commissariat Wharf, the old engineer offices, several private houses and the Canton Bazaar. It has accommodation for 134 sick. There is one main building with two detached wings. The right or west wing is occupied by the R.E., who have an office and mess-house, as well as quarters for officers there; the left wing, on the east, was originally intended for a female hospital and quarters for one sick and three medical officers; but want of room in the central building has made it necessary to accommodate sick soldiers there, instead of their wives in the two principal wards. A wooden partition in the side verandah of the east wing divides the Female Hospital from the officers' quarters. On the ground floor under the officers' quarters are two rooms for officers' servants and one room marked PRINCIPAL MEDICAL OFFICER. But this last, were it otherwise eligible, cannot be used as such, in consequence of its distance from that officer's house. The use of the west wing gives an additional accommodation for thirty-two sick, making a total number of 166 beds (1845). The drains terminate in Victoria harbour, the east close to Wellington Battery. A considerable part of the ground has been gained from the sea. Behind the hospital (north) is an area covered with gravel, defended from the encroachments of the tide by a thick wall of granite on the west and by Wellington Battery of nine guns on the east.

"In front of the hospital is a large area, which is separated from the Queen's Road by a dwarf wall, surmounted by a wooden railing. These areas have been tastefully laid out by the engineer department in gravel walks and grass plots and planted with trees, shrubs and flowers.

"Opposite the hospital, on the other side of Queen's Road is Artillery Hill, where the native hospital is on the brink of a hill, which has been here cut away perpendicularly for the Queen's Road to pass" (Dr. Kinnis, 1846).

By 1865 the hospital ship "Hercules" occupies a prominent position, as a worn-out condemned hulk, just sufficiently water-tight to lie in a few feet of water near enough to the shore to give some hope to those on board of reaching land should a typhoon arise!

Ultimately the hospital ship "Meanee," a picture of which adorns the walls of the C.O.'s office in the present Military Hospital at Hong Kong, became the Military Hospital after the Parliamentary inquiry of 1866. She appears frequently in the notes of these times, and led to much correspondence. In the typhoon of 1874 she suffered a good deal of damage, one result of which was the provision of two naval petty officers to take nautical charge of her in typhoons. Another was the provision of a covered-in rowing boat, instead of the steam launch asked for, and more often than not, the boat, being top heavy, was blown down the harbour and had difficulty in making the ship's side in any breeze. One would

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like to know how the orderly medical officer fared in these days. A casualty ward was maintained on shore for accidents and urgent sickness occurring at night. The principal medical officer in 1874 records, "I think it very questionable, if the advantage of having the hospital afloat counterbalances its many disadvantages. The Naval Authorities have a convenient hospital on shore."

What a curious position, the Naval Hospital ashore and the Military Hospital afloat!

The new Military Hospital dates from 1901, and is an excellent building on Bowen Road, overlooking the harbour from about 400 feet up the hill-side. The original plans included a family hospital, which, however, did not materialize.

Bowen Road is the path over the main water-conduit, and until recently, dhoolies and wheeled-stretchers were the only means of transport for the sick. In 1929, a "Baby Austin" was converted locally, by the Royal Army Ordnance Corps, into a miniature motor ambulance, which takes one lying case all the way up to the hospital—almost into the reception room itself!

In conclusion, the question of paroxysmal fevers in Hong Kong and Kowloon may be reviewed and brought up to date. Malaria was present before cuttings and excavations were begun, the prevalence of the disease was only increased through the importation of carriers and the provision of more breeding places. The benign tertian type has predominated recently, though in some previous years both benign and malignant malaria have been equally prevalent, e.g., in 1906 there were 139 malignant tertian and 134 benign tertian cases. In that year, eight quartan cases are recorded, and in 1912 two other similar cases occurred, and even now an odd case of such is diagnosed in the laboratory. Occasional cases of malaria are sent in from Mount Davies, Mount Austin Barracks and Stone-cutters' Island. The disease may be said to have been prevalent at times recently, at Lyemun Musketry Practice Camp, Kowloon, and the New Territories.

A new epoch awaits Stanley, where a magnificent college, St. Stephen's College, has been erected on the site of the old barracks.

In the town of Hong Kong, in the vicinity of the barracks and hospital, no anopheline breeding-places have been discovered recently, though ample facilities would appear to exist for such along the many watercourses down the hillside. It may be noted that there was an outbreak of malaria at Bowen Road Hospital in 1910. Numerous breeding places have been found however, where literally countless numbers of culicine larvæ have been observed. No full explanation is yet forthcoming as to the absence of malaria in one year, with marked prevalence in the same place and at the same season in another year.

When the Shanghai Defence Force resided at Kowloon, there was no epidemic of malaria, and by some it was reasoned that malaria did not occur

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there. What a contradiction the experience of the musketry camps has shown this to be! In some years the camps improved the fitness of the men. In other years—even as recently as 1928—the camps had to be abandoned. Sai Wan abandoned in 1846; Lyemun, next door, still giving rise to malarial fevers in 1929!

No one can say yet that Hong Kong, Kowloon and the New Territories are free from paroxysmal fevers. The appointment of a new Principal Civil Medical Officer, with a special knowledge of malaria problems and anti-malaria work, has rightly given rise to a spirit of optimism. In some countries, the incidence of malaria is indicated, in no uncertain manner, by a falling off in the annual successful output of labour, and so anti-malaria measures proceed rapidly. In Hong Kong the Annual toll of malarial sickness does not readily show itself, but one feels sure that the day is not far distant when at last the administration will be in a position to declare that the danger of paroxysmal fevers no longer exists within their territories.

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The standard work on Hong Kong is the History by Dr. Eitel, a copy of which work it has not been possible to obtain in the preparation or revision of these notes. The main reference is the Official Report of the Select Committee of the House of Commons on the Mortality of Troops in China, a copy of which was kindly loaned by Mr. J. Barrow, of the Colonial Civil Service (Hong Kong), son of Major-General H. P. W. Barrow, and grand-nephew of Colonel F. E. Barrow, whose views on "disintegrated granite" have been recorded. The extracts in the beginning of the article are taken from H. C. Sirr's "China and the Chinese," 1848.

The pamphlet, containing the lecture by Dr. Kinnis, was found by accident in the City Hall Library. There are many extracts from the bound volumes of the "Chinese Repository," 1841. One of the best volumes of this was missing; according to the index it contained plans of very early Hong Kong.

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Current Literature.

HUNTER, GRACE H. **The Rôle of Female Dietitians in the American Army.** *Revue Internationale de la Croix Rouge*, February, 1930.

The idea of employing female dietitians with the American Army originated with the Red Cross. The committee of the New York Red Cross decided in 1907 to enrol female dietitians for hospital service. The reports on the home-nursing classes in 1902 mentioned the possibility of forming classes of instruction in dietetics. The first class was organized in February, 1917. These classes became very popular during the war and a National Committee of female dietitians was organized to supply instructors and to provide dietitians for the base hospitals. At the end of 1917, 645 women had been enrolled as instructors and 211 had entered into the military hospitals for service under the Red Cross.

In 1919, the Surgeon-General reported that the value of proper food for the sick was now so well recognized that dietitians had become permanent collaborators in all well-organized military hospitals.

In order to satisfy the requirements of Army hospitals a school of dietetics was organized in 1922, under the direction of Brigadier-General J. D. Glennan, Commandant of the Walter Reed Hospital. In order to qualify for the courses candidates had to attend college for two years and to have graduated at a recognized school of domestic economics. In 1926 attendance at college was raised to four years and a science degree, specializing in chemistry and dietetics, had to be obtained. Candidates for employment in the Army were chosen with great care; they had to pass a severe physical examination, give a complete list of the courses they had followed at college or at a University and produce two letters of recommendation.

The report on hospital standardization, dated October 1, 1927, distinguished three classes of dietitians: administrative, scientific and educational.

The female Army dietitian must have a profound practical knowledge of foods. She is responsible that the diet contains sufficient calories and is properly varied, that loss from the food left over at meals is reduced to a minimum. She defines the duties of the employees and watches their work. She also visits the wards and dining halls and keeps in touch with the doctors, medical attendants and the sick.

The cost of food constitutes about one-third of the total expenditure of a hospital, so unless the work of the dietitian is properly done considerable loss of money may result.

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Reviews.

RECENT ADVANCES IN TROPICAL MEDICINE. By Sir Leonard Rogers, C.I.E., M.D., F.R.S. Second Edition. Pp. x + 439. London : J. A. Churchill. 12s. 6d.

This title is somewhat misleading, for the author has been at pains not only to discuss recent advances in tropical medicine, but also to give most useful summaries of our knowledge regarding the long series of diseases with which he deals, so that the volume instead of merely imparting a final touch of up-to-date polish could be used as a textbook by those already possessing a working knowledge of tropical medicine. As in the foregoing edition, the author stresses the treatment and prevention of disease rather than the niceties of pathology and laboratory technique, refinements which, he points out, the practitioner in the tropics has rarely the time or opportunity to make use of. The new matter in this edition includes sections on Oroya fever and verruga peruana, granuloma inguinale and climatic bubo, additions made without any material enlargement of the book. To every section there is appended a list of references which will prove very helpful to those who wish to consult the original publications.

HYPOCHONDRIA. By R. D. Gillespie, M.D., M.R.C.P., D.P.M. Psyche Miniature Medical Series. Kegan Paul. 1929. Pp. 104. 2s. 6d. net.

The author begins his admirable monograph with a scholarly review of the history of hypochondria. In the next chapter he deals with the somewhat hazy ideas which have obtained on the nosology of the condition, and throws into clear relief the distinctions between neurasthenia, hysteria and hypochondria. The psychopathology presents many difficulties. Among other things its preponderance, as a separate entity, among males of the later ages has to be explained. This predilection for one sex creates a difficulty for those who regard it as a mental reaction to difficulties, whether internal or external, for these rather tend to be the prerogative of the female sex in middle age.

We are strongly disposed to accept the author's opinion that no organic disease necessarily underlies hypochondriacal symptoms, for these are on occasion met with in pure form in young and healthy subjects.

The psycho-analytic theories of hypochondria include certain aspects of narcissistic regression and anal eroticism. The author is of the opinion also that homosexual repression and guilt reaction explain certain cases. This would help to explain the preponderance in the male sex, for homosexual repression is not a strong factor in women ; it would not, however, appear to be so helpful in explaining the late age incidence. The psycho-

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analytic view is very well summarized—not always an easy feat! Some interesting points arise, in passing, on the subject of the psychology of pruritus. The book concludes with further information on the history and literature.

Hypochondriacal ideas loom large in the insane mind, and those interested in psychiatry will find this able little monograph instructive and stimulating. It is, however, by no means only psychiatrists who meet with hypochondria, and we can cordially recommend this little book to any practitioner. It is excellently printed and got up.

ON PRESCRIBING PHYSICAL TREATMENT. By Dr. Mathew Ray, M.D. London: William Heinemann (Medical Books), Ltd. 1929. Pp. ix + 179. Price 10s. 6d. net.

This book is written entirely from the standpoint of the prescriber and is essentially of a practical nature. In it are described all varieties of baths and douches, massage and electrical currents, and there is a final chapter embodying the results of recent work in ultra-violet ray therapy.

Details of technique, physiological action as well as therapeutic indications are described under separate headings. This method of dealing with the subject is useful, as baths, mud packs, and many other physical treatments would be utilized far more freely if the effects and technique of their application were better known. Perusal of this book demonstrates the practicability of medicated bath and spa treatment in or near the home or hospital.

The subject matter with suitable illustrations is presented in an eminently readable form, and a good index makes this book a valuable work of reference.

LANDMARKS AND SURFACE MARKINGS OF THE HUMAN BODY. By L. Bathe Rawling, F.R.C.S. Seventh Edition. London: H. K. Lewis and Co., Ltd. 1929. Pp. viii + 98. Price 7s. 6d. net.

The fact that a further edition was called for after a four years' interval shows the continued popularity of this well-known work. The uniform excellence of the illustrations remains unimpaired, and a further improvement is effected by five new figures of the ankle and foot. As well as landmarks and surface guides there is a great deal of solid everyday anatomy contained in this work.

A minor criticism may be made that though a quotation is given of Nélaton's line, no mention is made of the necessity, recorded by him, of eliciting the sign with the thigh in a position of flexion and slight adduction.

Excellent appendices are provided, giving lengths of passages, weights of organs and ossification tables.

The book continues to form a valuable adjunct to any medical officer's travelling library.

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A Textbook of Hygiene. By J. R. Currie. Edinburgh: E. and S. Livingstone. 1930. Pp. xix + 844. Price 27s. net.

This textbook of hygiene, written by J. R. Currie, is well worth perusal both by the student reading for his final and by candidates for the Diploma of Public Health.

An enormous amount of valuable information is enclosed within its covers.

The book is clearly printed, and well illustrated. More diagrams and illustrations of sanitary appliances might with advantage have been given.

The insertion at the end of each chapter of the provisions of the various Public Health Acts relating to the contents of the chapter is practical and convenient. The article on refuse and sewage disposal is especially well written and instructive. The bio-aeration processes, generally difficult to understand, are clearly explained, and one method is illustrated.

The chapter on food is particularly well arranged, and gives all necessary information on the subject.

The chapters on statistics and meteorology are fuller than is usual for a volume of this size. They are written in an interesting style, and the charts, illustrations, etc., are clear and easily understood.

Considering the interest and importance of malaria and its prevention, the amount of space allotted to this subject is inadequate—barely a page is indeed short measure. Service officers, and medical officers in the tropics are not likely to have more than one work on hygiene with them, and expect to have this great problem treated at length and profusely illustrated.

The space devoted to the life history of the fly, and the measures for its destruction, is insufficient.

These, however, are small blemishes on a well-written and valuable work. N. L.

The Mobilization of Ankylosed Joints by Arthroplasty. By W. Russell Macausland, M.D., and Andrew R. Macausland, M.D. Philadelphia: Lea and Fibiger. 1929. Pp. vii + 252. Price $7·00.

This short volume of 244 pages deals with the very specialized methods of arthroplasty.

It is divided into four parts: the first part deals with the types, ætiology, and pathology of ankylosis, followed by a description of the functional positions of the individual joints, and the treatment of ankylosed joints. In the second part are described the various methods of arthroplasty, the indications and contra-indications, the results, and experimental work. The third part deals with the treatment of specific joints; in the fourth part the prevention or minimization of ankylosis is described.

At the end of each part a full bibliography is appended.

The volume contains a great deal of information on a very specialized subject, which is not to be found in the standard textbooks. A full

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description of the operative technique is given with illustrations, and the volume can be throughly recommended to anyone interested in this special branch of surgery. J. M. W.

A SHORTER SURGERY. Second Edition. By R. J. McNeill Love. London: H. K. Lewis and Co., Ltd. 1930. Pp. xvi + 371. Price 16s.

This volume has been increased in size by seventy-one pages. Many of the chapters have been re-written and new illustrations added; also chapters on specific diseases, fractures and dislocations have been added.

The author intends the volume to be used in conjunction with one of the standard surgical textbooks and in no way attempts to cover the whole field of surgery.

The book does without doubt give a great deal of help in the way of classifications and requisites for examinations which is not to be found in the same form elsewhere. It is of a handy size, excellently got up, and should be of great use in preparing for the higher surgical examinations.

J. M. W.

Correspondence.

MEDICAL TACTICS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—The continued appearance of articles on medical appreciations shows that there are many differences of opinion on the subject. I would venture to suggest that a book on "Medical Tactics" be published, which would lay down the form required.

The officers who have attended courses at the Staff College and the Senior Officers' Course would collaborate.

The book would deal with medical tactics under the various circumstances of battle and would answer problems such as:—

"Under what circumstances are W.W.C.P.'s required?" The ideas at present on the subject are immensely varied.

It would deal with Major Reynolds's inquiries about the calculation of casualties, etc.

There appears to be ample scope for a publication of this nature, which would be of great assistance to officers in learning their job.

Devonport.
May 21, 1930.

I am, etc.,
N. CANTLIE,
Major R.A.M.C.

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Journal

OF THE

Royal Army Medical Corps

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VOL. LV.

July—December, 1930.



JOHN BALE, SONS & DANIELSSON, LTD.
83-91, GREAT TITCHFIELD STREET, OXFORD STREET, W. 1.

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VOL. LV. JULY, 1930. No. 1.

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Journal
of the
Royal Army Medical Corps.

Original Communications.

A STUDY OF CERTAIN FEATURES IN CONNECTION WITH ENTERIC GROUP INFECTIONS IN THE ARMY IN INDIA.

BY MAJOR J. A. MANIFOLD, D.S.O.
Royal Army Medical Corps.

(*Continued from p.* 421.)

RESULTS OF WIDAL TESTS ON TWENTY-FOUR BACTERIOLOGICALLY PROVEN PARATYPHOID B CASES.

Twenty-four series of tests only are available in which sufficient examinations were carried out. The series is too small to be of any great value, but the results are interesting and raise certain questions which require elucidation. The average number of tests per case is also less than in the other groups examined, viz., 3·83 per case.

British troops .. 11 cases
Indian troops .. 13 cases

Severe cases .. 10 (duration of pyrexia 23·1 days)
Mild cases .. 14 (duration of pyrexia 11·7 days)

CLASSIFIABLE BY AGGLUTINATION AS PARATYPHOID B, 11, OR 45·8 PER CENT.

Six of the 11 classifiable cases were severe. Of the 11 British cases only 4 are classifiable, and 3 of these are severe in nature. The initial rise in "B" agglutinins was apparent as early as 10th to 11th day in the few tests which covered this period. "T" agglutinins were affected in a higher percentage than those for "A." The peak of the curve of agglutination may be found at a late period after onset, as in the case of "T" and "A" infections.

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Case I, V.

	13th	19th	25th	27th	35th	43rd	49th day	
B. typhosus	10	0	9	11	11	15	15	S.A. units
B. paratyphosus A ..	71	63	37	33	54	37	27	
B. paratyphosus B ..	8	21	281	117	2,354	370	477	

Severe case, pyrexia 27 days. Inoculated with 1 c.c. T.A.B. 42 days before onset.

Unclassifiable by Agglutination as Paratyphoid B, 13, or 54·1 per cent.

Nine cases are classed as mild and 4 as severe.

A general rise in T.A.B. is present in 7.

The fluctuation in "B" agglutinations is slight in the majority. In 9 it is under 300 per cent, and in 6 of these it is under 100 per cent. In 2 cases, or 8·2 per cent of the 24 cases, there is no increase in "B" agglutinins.

Illustrative cases are :—

Case B, 9.

	7th	15th	22nd	32nd day		
B. typhosus	76·9	48	12·5	5	S.A. units	Positive blood-culture 7th day. Mild case, 15 days pyrexia. Inoculated with 1 c.c. T.A.B. 142 days before onset
B. paratyphosus A ..	105·2	158·1	114·3	342·8		
B. paratyphosus B ..	103·6	89	166·6	250		

Although the "B" agglutinins show a higher percentage rise than "A" on 22nd day, the irregular nature of the rise, and the rise in "A" on 15th and 32nd day, would leave to doubt as to the diagnosis, had not *B. paratyphosus* B been isolated and confirmed as such.

Case B, 7.

	7th	9th	17th	22nd day	
B. typhosus	19·2	19·2	19·2	19·2	S.A. units
B. paratyphosus A ..	119	297·6	119	39·5	
B. paratyphosus B ..	15·6	15·6	15·6	15·6	

Although the cases under examination are few and the Widal tests not as complete in many cases as they should be, there seems little doubt that satisfactory results would not be obtained with the test as employed at present in more than 50 per cent of cases.

Again, the general rise in agglutinins or the mildness of the majority of the cases leading to small rises only is responsible for the difficulty in diagnosis.

There are, however, other factors involved. The writer noted the unsatisfactory results in paratyphoid B infections when going through the Widal results at the end of 1927, and raised the question with Major R. F. Bridges, R.A.M.C., the officer in charge of the Enteric Laboratory at Kasauli, as to whether many of the bacilli confirmed as *B. paratyphosus* B on biochemical reactions and agglutination tests were not in reality other organisms of the Salmonella group, which could only be properly classified by absorption tests, etc. If this were so, the irregular rise in the "B" agglutinins in the so-called paratyphoid B cases could be explained as being

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due to a sympathetic rise of group agglutinins. A further point was noted on scrutinizing the Widal results of "enteric group" cases at the end of 1927, which seemed difficult to explain in view of the irregular results of the tests on bacteriologically proven paratyphoid "B" cases, namely, that a considerable proportion on their Widal tests alone would actually be classified as due to paratyphoid B infection. Similar results were found at the end of 1928. Of the 295 enteric group cases selected at random for examination, 14·7 per cent are classifiable as paratyphoid B, and 13·27 per cent as paratyphoid A. *B. paratyphosus* B has always been considered a rare infection in India, and *B. paratyphosus* A as comparatively common. (See Table I.)

From the Widal tests it seems as if infection with Salmonella group organisms, including *B. paratyphosus* B, is much commoner than has been suspected, and possibly a considerable proportion of our "short fevers" may be due to infection with this group of bacilli.

It is probable that Salmonella group bacilli are present in the blood-stream in small numbers and for short periods, and are therefore difficult to isolate by blood-culture methods. Owing to the difficulties of climate, and in the collection and despatch of specimens of fæces from hospitals to laboratories, by far the larger percentage of positive results in enteric fevers in the Army in India is obtained by blood-culture. It is easy, therefore, to understand how positive bacteriological results have been few in such cases in past years. It is only since Dreyer's method of agglutination has been universally employed in military laboratories that any indication of the extent of such infections is becoming apparent.

Rosher and Wilson, in 1921 [22], reported a case of enteric-like fever which gave a typical agglutination curve to *B. enteritidis* (Gaertner). These authors quote Bainbridge as stating, in his Milroy lectures 1912, that the consumption of meat infected with Gaertner's bacillus, or *B. suipestifer*, may cause a pyrexia lasting two or three weeks. They also quote Savage's "Food Poisoning and Food Infections, 1920" and Buchanan's report to the Local Government Board in 1896, in which certain cases among those involved in a food-poisoning epidemic were stated to have suffered from a continued pyrexia only.

The writer, in 1928 [23], put forward the view that infection with aertrycke bacilli is probably common among the pariah dogs which infest India, and suggested that some of the short fevers among the troops might be due to aertrycke infections carried by those dogs.

Major R. F. Bridges has been carefully investigating all organisms referred to him during 1928 for confirmation as *B. paratyphosus* B. It is hoped that in due course he will report his results, but, with his permission, it may be mentioned that a small number have been proved to be *B. paratyphosus* C and *B. aertrycke* Newport, and a few others appear to be of a distinct serological type not previously reported.

In his annual report for 1928, Major Bridges writes: "As the result of

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a single year's working it may be surmised that many organisms have been classified at the E.F.C. Depot as paratyphoid B, when in reality a number of them were undifferentiated Salmonella types, definitely not para B. In his own experience the writer can recall several strains which presented unusual features, and yet were returned by him as paratyphoid B, since it was impossible at Naini Tal in the press of hospital and other work, to carry out prolonged study of these organisms."

Rosher and Fielden, 1922 [24], put forward evidence to show that in normal triply-inoculated individuals agglutination of *B. aertrycke*, and *B. paratyphosus* C may follow as the result of the "B" element of the vaccine, whereas *B. enteritidis* (Gaertner) seems to be co-agglutinated both by the typhoid and paratyphoid B elements. They point out that repeated tests by Dreyer's method would be necessary before a definite diagnosis could be arrived at. In this connection it may be mentioned that a large number of the routine Widal tests are carried out against T, A, B and C emulsions, and that the number showing any agglutinin units to "C" is very small. This is probably due to the fact that the emulsions at present in use are prepared only from the specific phase of diphasic Salmonella group bacilli.

A further element vitiating the results of Widal tests on the enteric group cases which are classified as paratyphoid B, may be the high percentage of cases in which the "B" elements are involved in typhoid infections. It has already been shown that 3·2 per cent of 152 bacteriologically proven typhoid infections would have been classified on their Widal tests alone as paratyphoid "B." In addition, it is shown later that the "B" element of the T.A.B. vaccine appears to give rise to a greater production of agglutinins than either the "T" or "A" elements.

Another element of doubt, according to Major Bridges, is the standardization of the emulsions of paratyphoid B; a procedure which is possibly not as simple as usually considered. This need not be discussed further here, and is only mentioned to show that there are many factors which may lead to error in the readings of Widal tests, as at present carried out, with regard to the paratyphoid B element. It seems certain that the range of organisms used in the test will have to be increased by at least *B. enteritidis* (Gaertner) and *B. aertrycke* (Mutton and Newport), and possibly by others. By the employment of the specific strains of these organisms for the formolized emulsions, it is probable that interesting results would be obtained.

ENTERIC GROUP, 295 CASES.

Classifiable by agglutination, 56·9 per cent; unclassifiable, 43·05 per cent; average tests per case, 4·63; initial tests on or before 8th day in 80 per cent.

British Troops (131).

Classifiable as typhoid	29 or 22·1 per cent	} 55·6 per cent	
Classifiable as paratyphoid A	20 ,, 15·2 ,,		
Classifiable as paratyphoid B	24 ,, 18·3 ,,		
Unclassifiable	58 ,, 44·2 ,,		

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Indian Troops (164).

Classifiable as typhoid	57 or 34·7 per cent	57·7 per cent
Classifiable as paratyphoid A	19 ,, 11·5 ,,	
Classifiable as paratyphoid B	19 ,, 11·5 ,,	
Unclassifiable	69 ,, 42 ,,	

The severity of the attack again appears to have an important bearing on whether the cases are classifiable on their Widal tests or not.

British Troops, 131.

Mild cases	..	104 or 79·3 per cent
Severe cases	..	27 ,, 20·6 ,,

Mild Cases, 104.

Classifiable	56 or 53·8 per cent	T. .. 19 or 33·9 per cent
		A. .. 16 ,, 28·5 ,,
		B. .. 21 ,, 37·5 ,,

Severe Cases, 27.

Classifiable	17 or 62·9 per cent	T. .. 10 or 58·8 per cent
		A. .. 4 ,, 22·5 ,,
		B. .. 3 ,, 17·6 ,,

Indian Troops, 164.

Mild cases	..	117 or 71·3 per cent
Severe cases	..	47 ,, 28·6 ,,

Mild Cases, 117.

Classifiable	63 or 53·8 per cent	T. .. 36 or 57·1 per cent
		A. .. 11 ,, 17·4 ,,
		B. .. 16 ,, 25·3 ,,

Severe Cases, 47.

Classifiable	32 or 68·0 per cent	T. .. 21 or 65·6 per cent
		A. .. 8 ,, 25 0 ,,
		B. .. 8 ,, 9·3 ,,

With the exception of the higher percentage of cases classifiable as paratyphoid B among British troops, and as typhoid among Indian troops, there is little difference in the results. The tests on both British and Indian cases are therefore considered as a whole.

Total Cases, 295.

Severe .. .. .. 74 (24·7 per cent)
Mild .. .. .. 221 (75·2 ,,)

Classifiable as typhoid : 86 or 29·1 per cent—
Severe cases .. 31 (36·0 per cent) ; average pyrexia 29·7 days
Mild cases .. 55 (63·9 ,,) ,, ,, 15·8 ,,

Classifiable as paratyphoid A : 39 or 13·2 per cent—
Severe cases .. 12 (30·7 per cent) ; average pyrexia 26·6 days
Mild cases .. 27 (69·2 ,,) ,, ,, 14 ,,

Classifiable as paratyphoid B : 43 or 14·5 per cent—
Severe cases .. 6 (13·9 per cent) ; average pyrexia 22·1 days
Mild cases .. 37 (86·0 ,,) ,, ,, 16 ,,

Unclassifiable : 127 or 43 per cent—
Severe cases .. 25 (19·6 per cent) ; average pyrexia 26·6 days
Mild cases .. 102 (80·3 ,,) ,, ,, 16·1 ,,

Classifiable cases : 168 (56·9 per cent)—
Severe cases .. .. 29·1 per cent
Mild cases .. .. 70·8 ,,

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These cases require little comment, as in all respects the reading of the results has been on the same lines as for the bacteriologically proved cases, and the nature of the agglutination response to infection in these "group" cases has followed in all respects the sequence of events in the proved infections, both as regards the regularity of the rise in the majority, and the various irregularities in the minority. Details are given in Appendix IV.

The general rise in specific, and in one or both elements of the inoculation agglutinins, is again apparent, 62 per cent in the cases classified as typhoid, 63 9 per cent in cases classified as paratyphoid A, and 85 per cent cases classified as paratyphoid B. In "T" and "A" the percentages are practically the same as in the bacteriologically proved cases. The higher percentages in which general rise to all these elements occurs, in the cases classified as paratyphoid B, seem to lend support to the theory that many of these cases are in reality Salmonella group infections, and the general reaction one of group agglutinins only, naturally highest in the "B" element.

The following case suggests the possibility of *B. fæcalis alkaligenes* being also a cause of a general rise in T.A.B. agglutinins, greatest in B:—

Case B, 11.

	9th	13th	17th	21st day		
B. typhosus	76·9	86·9	153·8	153·8	S.A. units	Mild case, 22 days pyrexia. *B. fæcalis alkaligenes* isolated from urine on two occasions
B. paratyphosus A ..	32·1	64·1	67·3	67·3		
B. paratyphosus B ..	297·4	1,113·2	1,113·2	804·1		

The Widal tests on another case classified in this series as paratyphoid B are worth recording.

Case B, 21.

	2nd	7th	12th	15th day	
B. typhosus	448	234	74	258	S.A. units
B. paratyphosus A ..	143	143	167	75	
B. paratyphosus B ..	21	44	446	893	

This case was one of very mild catarrhal jaundice, and "*definitely apyrexial.*" A mild form of jaundice with trifling symptoms is of fairly common occurrence in most stations in India, sometimes in mild epidemic form. The necessity for blood-culture and bacteriological examinations of the stools and urine in all such cases is clearly indicated by the tests given above.

The relation between the severity of the illness and the extent of the agglutinin response is well illustrated among the classifiable cases.

PERCENTAGE OF CASES DEMONSTRATING OVER 100 PER CENT RISE IN S.A. UNITS.

Typhoid	Paratyphoid A	Paratyphoid B
Severe cases 54·8 per cent	Severe cases 66·8 per cent	Severe cases 33·3 per cent
Mild cases 41·8 ,,	Mild cases 52·9 ,,	Mild cases 27·0 ,,

The classification of cases as severe or mild by medical officers must be very uniform, as can be seen from the closely parallel results of the Widal tests on British and Indian cases, both in the "group" infections and those

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bacteriologically proved, e.g., positive Widal results were obtained in 53·8 per cent of mild enteric group infections in both British and Indian troops, and of the mild typhoid (proved) cases, 36·5 per cent among British troops, and 36 per cent among Indian troops are unclassifiable on the results of their Widal tests alone. By a reference to the Appendices it will be seen how uniform the results are in almost all the various groups of tests.

UNCLASSIFIABLE CASES, 127, OR 43 PER CENT.

British troops $\frac{58}{131}$ or 45 per cent.

Indian troops $\frac{69}{164}$ or 42 per cent.

Severe cases (average pyrexia, 21·6 days), 19·6 per cent
Mild cases (average pyrexia, 15·9 days), 80·3 per cent.

The difficulties in the readings of tests of this group are the same in all respects as those recorded before when discussing the unclassifiable cases of typhoid, paratyphoid A and B. Only brief comment is therefore necessary.

A rise in group agglutinins is found in 62·3 per cent of cases, British and Indian, but in only a small percentage in this rise really high. Only 10·2 per cent of the tests show a fluctuation of over 1,000 per cent, and many of these are very irregular in nature. The agglutination indices are unchanged; they definitely drop from the initial test, or show no fluctuation above 100 per cent in 47·8 per cent of the Indian cases, and 58·6 per cent of the British cases. This is a higher percentage than was found by Sir William Leishman in his examination of the results of tests on 223 enteric group cases in France [15], the percentage in these cases showing no change, etc., being 35·4 per cent.

In the British group of cases under review no trace of a rise can be found in 17 cases, or 29·3 per cent. It might be considered that many of these cases were not true enteric group infections, but it has been shown already that no rise in titre to the infecting bacillus may occur in an even larger percentage, e.g., 32·4 per cent of 55 unclassifiable typhoid cases, and 47·3 per cent of 19 unclassifiable paratyphoid A cases.

The small extent of the rise is as important a cause of failure as the rise in group agglutinins. Deducting the cases in which no rise throughout is present, in 46 of 65 Indian cases and in 28 of 41 British cases, the rise is under 300 per cent.

The fact that a definite drop from the initial test in the agglutinin content of the serum may result from an enteric group infection in lieu of a rise does not appear to have been stressed. Some such cases can no doubt be explained on the ground that the medical officer had under-estimated the period of illness prior to the patient coming under observation. But the cases are too many for this to be the explanation in all. This result of infection may be found in both severe and mild cases.

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Tests given below illustrate some of the main difficulties in the readings in this series of cases.

(1) *General Rise*

Case B, 37.

	6th	12th	19th	25th day		
B. typhosus	46	242	184	48	S.A. units	Severe case, 21 days pyrexia. Inoculated with 1 c.c. T.A.B. 202 days before onset.
B. paratyphosus A ..	55	153	153	75		
B. paratyphosus B ..	50	286	222	129		

(2) *Early Rise followed by Drop.*

Case I, 44.

	4th	9th	13th	17th	24th	31st	38th day		
B. typhosus ..	305	985	39	157	157	161	243	S.A. units	Mild case, 21 days pyrexia. Inoculated with 1 c.c. T.A.B. 393 days before onset.
B. paratyphosus A	46	40	16	40	35	49	28		
B. paratyphosus B	47	32	28	32	32	44	22		

(3) *Drop from Initial Test followed by Late Rise to one Element, Rise not Persisting.*

Case I, 25.

	5th	13th	21st	26th	29th	37th	43rd day		
B. typhosus ..	87	55	23	19	17	8	17	S.A. units	Severe case, 23 days pyrexia. Inoculated 68 days before onset with 1 c.c. T.A.B.
B. paratyphosus A	14	14	8	8	48	7	8		
B. paratyphosus B	39	20	17	34	7	7	28		

(4) *Trace Rise only.*

Case I, 22.

	9th	13th	17th	22nd	27th	34th	42nd day		
B. typhosus ..	43	38	52	43	43	29	38	S.A. units	Mild case, 14 days pyrexia. Inoculated with 1 c.c. T.A.B. 53 days before onset.
B. paratyphosus A	60	52	77	60	39	40	33		
B. paratyphosus B	43	21	56	43	56	22	38		

The unsatisfactory results obtained, both in the above group and with the unclassifiable cases in the bacteriologically proved group, are in no way connected with the effects of "recent inoculation." For example, among the 69 Indian unclassifiable enteric group cases, the average period which has elapsed since inoculation and prior to the onset of the disease works out at 196·4 days. The infection occurred in 5 cases within one month of inoculation, in 8 cases between thirty and sixty days after inoculation, and in 7 cases between sixty and ninety days after inoculation; a total of only 28·9 per cent within three months of inoculation.

B, 37, I, 22 and I, 25 illustrate cases in which the infection occurred under one month, between one and two months, and between two and three months after inoculation. Exactly similar results are found in those cases in which many months have elapsed since inoculation.

The following two cases are interesting in that the patients were inoculated with 1 c.c. T.A.B. on the 2nd and 5th day *after* the onset of the disease and that in both the development of agglutinins is high. In a later section evidence is brought forward that the 1 c.c. dose of T.A.B. appears to cause a lowering of resistance to infection for a certain time, and that in a certain percentage of cases there may result a reduction in agglutinin content at first rather than an increase. In these two cases, inoculated *after* infection, the production of agglutinins does not appear to have been hindered in any way.

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Case B, 30.

	11th	18th	25th	32nd	39th	46th	53rd day		
B. typhosus ..	769	625	625	625	625	384	769	S.A. units	Moderately severe, 16 days pyrexia. Inoculated with 1 c.c. T.A.B. 2 days after onset.
B. paratyphosus A	263·1	256	128·2	128·2	64·1	32	64·1		
B. paratyphosus B	263·1	459·4	135·1	135·1	67·5	32·8	32·8		

Case B, 53.

	6th	13th	20th	27th	34th day		
B. typhosus	5	13	158	179	13	S.A. units	Fairly mild, 21 days pyrexia. Inoculated with 1 c.c. T.A.B. on the 5th day after onset.
B. paratyphosus A ..	3	185	184	197	14		
B. paratyphosus B ..	6	370	370	149	100		

The results of the Widal tests on these 522 enteric cases may be summarized as follows:—

I. One Hundred and Fifty-Two Typhoid Infections.

(1) Of the 152 cases 64 per cent are classifiable.

(2) Of the severe cases 75 per cent are classifiable.

(3) Of the mild cases 50 per cent are classifiable.

(4) Of the very mild cases (eight to eleven days pyrexia) 37·5 per cent are classifiable.

(5) The severity of the attack has, in the majority of cases, a marked effect on the development of specific agglutinins, so that a distinctive rise is found as compared with the rise in the inoculation agglutinins. "A" inoculation agglutinins are increased in severe typhoid infections to a greater extent than in the milder cases, whereas "B" inoculation agglutinins are affected in higher percentage of mild cases. In both severe and mild the "B" element is affected in a larger number of cases than "A."

(6) Although the above statement applies to the majority, a considerable number of cases occur in which the effects on the development of agglutinins is quite the reverse, i.e., a severe case may show no rise, and a very mild case a high rise, in specific agglutinin content during the period of the tests.

(7) The difficulty, and in 37 per cent the impossibility, of classifying the cases is due to the synchronous rise in inoculation agglutinins, mainly the "B" element, and also to the small rise in agglutinin content of the infection agglutinins which occurs in many cases, particularly when very mild. In 11·1 per cent (16 to 18 very mild or abortive) of the group under discussion no rise in specific agglutinins is evident throughout the series of tests for each case.

(8) A small percentage of cases (4·4 per cent) would have been incorrectly classified on Widal tests alone, viz., 1·2 per cent as paratyphoid A and 3·2 per cent as paratyphoid B.

(9) Although the majority of the classifiable cases show a rise and fall in agglutinin content which agree with the classical teaching, a large minority differ markedly in many respects. It is therefore necessary to commence the tests early in the illness and continue them to about the

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30th day, if as many cases as possible are to be correctly diagnosed. Five tests will be required in many cases to establish a correct diagnosis.

(10) The large majority of severe toxic cases which resulted in death have shown a high development of infection agglutinins during the illness, and up to the period at which death occurred.

(11) The effect of a relapse is almost invariably to cause an increased development in the agglutinin content of the patient's serum in the infection agglutinins and in some cases of the inoculation agglutinins.

II. Fifty-one Paratyphoid A Infections.

(1) 62·7 per cent are classifiable.

(2) 37·2 per cent are unclassifiable.

(3) Among the classifiable cases the relative rise of the infection agglutinins is higher than is found in the milder typhoid cases, but not quite as high as in the severe.

(4) In the unclassifiable cases the failure in the development of infection agglutinins is the main difficulty in the reading of the tests rather than the general rise in the inoculation agglutinins. In 17·6 per cent no rise is found.

(5) In general the curve of agglutination to the "A" element in the classifiable cases was precisely similar to that seen for "T" in typhoid infections, both as regards regularity and irregularity of the curves. Late rises of the infection agglutinins were not more frequent in the case of paratyphoid A infection than in typhoid infections.

(6) The effect of "A" infection on "T" inoculation agglutinins was rather less than on "B" inoculation agglutinins, 41·1 per cent being raised in the former, and 47·8 per cent in the latter.

(7) Although a greater relative rise may occur in both "T" and "B" agglutinins than in "A" as the result of "A" infection, in this series of cases the rise was either so irregular, or so closely followed by that of the "A" element, that no diagnosis other than enteric group is possible.

III. Twenty-Four Paratyphoid B Infections.

(1) Classifiable, 45·8 per cent.

(2) The severity of the illness appears an important factor in the development of specific agglutinins. In the milder cases the slight extent of the rise in specific agglutinin content is as important a source of difficulty as the rise in inoculation agglutinins.

(3) It is probable that this group includes a certain number of cases of Salmonella group infections as distinct from paratyphoid B.

(4) In 8·2 per cent of cases there is no increase in the "B" agglutinins.

(5) The number of cases under review is too small to give information of any real value.

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IV. Two Hundred and Ninety-five "Enteric Group" Infections.

(1) Classifiable, 56·9 per cent { 29·1 per cent typhoid infections. 13·2 per cent paratyphoid A infections. 14·5 per cent paratyphoid B infections.

(2) Unclassifiable, 43 per cent.

(3) The severity of the illness is an important factor as regards whether the case is ultimately classifiable by Widal tests.

(4) The high percentage of cases classified as paratyphoid B, particularly among British troops, is probably due to Salmonella group infections other than *B. paratyphosus* B causing a rise in group agglutinins, and possibly also to a small percentage of typhoid infections which have given rise to a greater response in the "B" element than in "T."

(5) In all other respects the tests on both classifiable and unclassifiable cases correspond with those on the bacteriologically proved infections, and results are very similar, the synchronous rise in inoculation agglutinins and also the small extent of the rise being the cause of the negative results.

(6) The number of cases in which no rise is found to "T," "A" and "B" corresponds very closely with the bacteriologically proved cases, i.e., 7·1 per cent of 295 "enteric group" cases, of which 5·7 per cent is among the British group, as compared with 11·1 per cent of proved typhoid infections and 17·6 per cent of proved paratyphoid A infections.

Discussion.

Since the above was written, an important paper concerning the value of the Widal test has been published by A. Felix [25]. The author summarizes the literature both from British and German sources, and points out the paucity of published information containing accurate figures of the results of tests on bacteriologically-proven enteric fever infections, and the wide claims which have been made in the absence of such published figures. The necessity of obtaining some exact figures in lieu of accepted generalizations was the cause of the present inquiry.

The assumption of Dreyer that there exists in enteric infections one type only of the curve of agglutinin production is queried, and attention is directed to the work of various investigators indicating that a variety of forms of agglutination curves may occur in typhoid fever, and that the maximum peak of the curve occurs just before defervescence, irrespective of any particular day after onset of the disease. The present series of tests also indicate that irregular curves occur in a large minority of cases, but the peak of the curve of agglutination may be met with either early or late in the course of the disease, and is not particularly related to the period just before defervescence.

The absence of definite figures as to the incidence of the synchronous fluctuation of the inoculation agglutinins is also commented upon. Such figures are given in the present paper for typhoid, paratyphoid A, and enteric group cases, and may be of some value.

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Felix concludes, however, that no technique based on the quantitative method of the agglutination reaction hitherto used is capable of differentiating between inoculation and infection agglutinins. This seems a very extreme statement, as extreme indeed as the claims of those who considered that positive results could be obtained in almost all cases. This is not the experience of workers in the military laboratories in India, by whom probably more Widal tests are carried out on inoculated individuals than by any other body of laboratory workers. It is agreed that in a fair percentage of cases the method does fail to enable a "definite classification" to be carried out, but the percentage in which it fails to enable an enteric group diagnosis to be made, if Dreyer's technique is followed, is small when applied to a large group of cases of moderate or high severity. In the very mild or abortive cases the percentage of failures is certainly high.

It has been shown conclusively in the present series that the severity of the attack, as judged by duration of pyrexia, toxæmia, etc., is an important feature as regards whether a distinctive rise in infection units as contrasted with inoculation units will result.

In severe typhoid cases such a distinctive rise occurred in 75 per cent of cases, a result practically as good as that found by Pijper (1923) in cases apparently uninoculated. In a mixed group of typhoid cases, of which 44 per cent were clinically mild (pyrexia 14·9 days only on the average), a distinctive rise was present in 64 per cent of cases.

In the very mild or abortive cases, however, the stimulus due to the infection is apparently too weak to enable a high percentage of cases to produce H agglutinins in sufficient amount to be distinctive, and in some cases there appears to be no response at all. If by the use of alcoholized O emulsions it will be possible to distinguish all such cases as "enteric group," a great advance will be made in the sorting out of the short pyrexias of doubtful origin so common in India. In such literature as the writer has seen on the subject no distinction, however, is drawn between the mild cases and the ordinary case of average severity, and it seems yet to be proved that an abortive or mild typhoid case with a pyrexia of five to eight days' duration will invariably show a titre for O agglutination above the limit of normal or inoculation O agglutinins. In cases with pyrexia of over fourteen days' duration, the usual clinical signs plus the ordinary Widal tests, using H emulsions and Dreyer's technique, enable a diagnosis of "enteric group" to be made at least in the very great majority of cases. It is in the cases doubtful both on clinical grounds and by Widal tests that some reliable test is required. If the use of O emulsions will help in this respect, a great advance on our present methods will have been made.

Felix also in the same paper emphasizes the fact that curves of agglutination diagnostic for enteric group infection occur in large numbers in non-enteric pyrexias among T.A.B. inoculated cases, and that the re-stimulation of the heterologous H agglutinins in the course of an enteric

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infection is of the same non-specific character as in the case of any other febrile condition.

Fluctuation was observed by Weil and Felix in "T" agglutinins in 40 per cent of typhus cases [26], but the percentage which would have been diagnostic of enteric group infection, using Dreyer's method, is not stated. Diagnostic curves were obtained in such diseases as pneumonia and influenza, etc. A. D. Gardner [27], in the same number of the *Journal of Hygiene*, states:—

"The view that non-specific T curves of diagnostic magnitude occur as the result of non-enteric infections (Anamnestic reaction) does not seem convincingly proved. Evidence against it is strong."

At the end of 1928 the writer asked eight of the officers in charge of district laboratories to send him details of Widal tests from cases of non-enteric pyrexias in which fluctuation of inoculation agglutinins had been observed. Widal tests on 1,129 cases were carried out during the year by these laboratories, the number of actual tests being probably in the neighbourhood of 5,000. 792 cases were diagnosed as non-enteric in origin. A rise or fall of the inoculation units as the result of infection was observed in 50 cases. The diagnoses included such diseases as malaria, hepatitis, bronchitis, influenza, rheumatic fever, tubercle of lung, tick fever, pleurisy, jaundice. The temperature charts of several cases were distinctly suspicious of enteric fever infection. In many cases the date of inoculation was not given, but in at least 20 the period between the illness and date of inoculation varied from five to twelve months. Fourteen cases might have been considered as belonging to the enteric group on Widal results, i.e., 5 malaria, 2 tubercle lung, 1 broncho-pneumonia, 2 bronchitis, 1 rheumatic fever, 1 pleurisy, 1 amœbic hepatitis, 1 inflammation areolar tissue groin. Bronchitis is a common symptom of typhoid infection among Indian troops. Malaria and enteric fever, as is well known, commonly occur in the same patient. The temperature chart of the amœbic hepatitis case referred to was distinctly suspicious of a paratyphoid infection. The pyrexia in this case lasted thirteen days. Emetine was administered for the first time on the twelfth day of pyrexia, and the temperature dropped to normal on the fourteenth day of illness, which would have been quite consistent with the diagnosis of paratyphoid B which was indicated by the Widal tests. Regarding one case of tubercle of lung, Major Smith, who forwarded details of the case, writes, "The case resembled one of typho-pneumonia, and it is questionable whether an enteric infection has not lit up an old T.B. focus."

In a few cases the fluctuation of inoculation agglutination was in the nature of a fall in lieu of a rise.

Experience in India therefore indicates that if Dreyer's method of agglutination, using formolized H emulsions, is employed, pyrexias of non-enteric origin give rise to a fluctuation of inoculation of agglutinins in a certain percentage of cases, but the number of curves of agglutination which would lead to a diagnosis of enteric group infection in cases of

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definitely non-enteric origin must be extremely few, although it is probable that such cases occasionally occur.

That the rise in inoculation units in enteric group infections is of the same non-specific nature as in non-enteric pyrexias seems difficult to credit. In the series of cases of bacteriologically proven typhoid cases, etc., synchronous rises in inoculation agglutinins are found in from 50 to 70 per cent. In non-enteric infections the inoculation agglutinins are not raised so frequently nor in the same degree. Rosher and Fielden [24] found that in normal inoculated individuals agglutination of *B. aertrycke* and *B. paratyphosus* C followed as the result of the "B" element of the vaccine, and that *B. enteritidis* (Gaertner) was co-agglutinated by the typhoid and paratyphoid B elements. Rosher also [28] showed that in a rabbit inoculated with *B. paratyphosus* B the titre of the serum to *B. paratyphosus* C was raised from 1 in 320 to 1 in 5,120 in seven days.

In typhoid infections the "B" agglutinins are definitely affected in a higher percentage than "A" agglutinins.

Hood [29] quotes two uninoculated cases of paratyphoid B infection in which co-agglutinins to *B. typhosus* appeared in the serum during the third week of infection.

Such cases are admittedly rare, but the following tests on an uninoculated infant (eighteen months old) suffering from an enteric group infection, both clinically and on the results of the Widal test a typhoid infection, appear to indicate that the production of co-agglutinins can occasionally occur in uninoculated cases.

	10th	15th	21st day	
B. typhosus	5·8	27	121	S.A. units
B. paratyphosus A	0	0	0	
B. paratyphosus B	0	0	17	

Another case suggesting a paratyphoid B infection is illustrated, although in this case no organism was recovered.

	7th	14th	23rd	32nd day	
B. typhosus	0	0	0	283	S.A. units
B. paratyphosus A	0	0	0	0	
B. paratyphosus B	19	46	92·5	325	

Leishman, when summing up the results of inoculation at the end of the Great War, was definitely of the opinion that the steady fall in the incidence of paratyphoid fevers which commenced in the middle of 1915 was connected with the steady rise in the percentage of T.V. inoculation in the British Armies in France, and that an appreciable degree of protection against paratyphoid fevers was given by the typhoid vaccine used.

He states, however, that "no trace of agglutinins or other antibodies to paratyphoid bacteria was ever found to develop in the blood of men or animals inoculated with typhoid vaccine, although this was carefully looked for, since in view of their belonging to the same bacterial group, such a development of co-agglutinins or other substances might not unreasonably have been expected."

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Practical experience with typhoid inoculation appears to have differed from the laboratory results, and also shows that co-agglutinins may occasionally be found as the result of infection with living bacilli.

One point which has forcibly impressed itself on the mind of the writer from the study of these Widal results is that the average inoculated individual cannot be looked upon as a machine to produce agglutinins by rule of thumb, as the result of a naturally acquired infection. Although in men or animals inoculated subcutaneously with graduated doses of T.A.B. an agglutinin curve exhibiting certain definite features may result, in a very large number of individuals who acquire infection naturally by the mouth such regular curves are not met with. The reasons appear numerous and obvious, and would include such matters as dosage, virulence of the infecting organism, extent and nature of previous immunity, natural or acquired, on the part of the patient, and many other imperfectly understood factors.

Finally, we may ask whether the results as ascertained by the examination of these 500-odd cases merit the routine employment of the Widal test in undiagnosed cases of pyrexia in the Army in India. If diagnostic results can be obtained in 60 per cent of a mixed group of cases, and a diagnosis of enteric group infection in 80 per cent of cases of average severity, the tests appear to remain a valuable aid in diagnosis, provided the limitations are realized and Dreyer's technique is employed in all details.

The test is, however, no substitute for careful bacteriological investigation or clinical observation and, if only two or three blood-cultures with aseptic precautions were taken during the first week of all pyrexias, would seldom be required. The taking of repeated blood-cultures in the early stages of the disease would be no more irksome either to the patient or the physician than the present system of vein puncture at weekly intervals to enable the necessary number of Widal tests to be carried out in accordance with the regulations in force. That a high percentage of positive results can be obtained by blood-culture methods in inoculated cases is shown in a further section. The test as employed at present distinctly fails in a high percentage of very mild and abortive cases. Atypical typhoid in India is no myth, and cases have recently occurred in which *B. typhosus* has been isolated by blood-culture from patients with a pyrexia of only two to three days' duration, who have actually been discharged to duty apparently fit, and brought back to hospital on receipt of a laboratory report stating that *B. typhosus* had been grown from the blood-culture. It is in these cases that the employment of O emulsions may be of the greatest assistance. If all claims are justified by further experience by using a combination of O and H emulsions, it may be possible to obtain a true diagnosis of enteric group in all cases, and a definite classification in 60 per cent of cases in which bacteriological investigations have failed.

Certain other details regarding enteric group infections are available from a study of A. Form I 3056, and may be of general interest.

(*To be continued.*)

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THE DIAGNOSIS OF DYSENTERIES.[1]

By Major A. G. BIGGAM, O.B.E.,
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The term "dysentery" is one applied to a symptom-complex in which there occurs the passage of frequent stools containing blood and mucus often accompanied by pain and tenesmus, these symptoms being produced by an inflammatory condition of the large intestine.

The nearer the inflammation approaches to the anal sphincter the more marked the tenesmus becomes, the inflamed mucous membrane near the anal orifice then being squeezed by the contractions of the sphincter muscle.

The three chief causes responsible for dysenteric symptoms in Egypt are:—

(*a*) Infection with *Entamœba histolytica.*

(*b*) Infection with dysentery bacilli.

(*c*) Irritation produced by the deposit of ova of the bilharzial worms, especially of the *mansoni* variety, in the wall of the large intestine.

The differentiation between these three varieties of dysenteries from the symptoms and physical signs is often extremely difficult and if a diagnosis be attempted by these clinical methods alone, mistakes will very frequently be made, often with very serious results to the patient.

We shall consider first of all very briefly the symptoms and signs associated with each variety of dysentery.

Bacillary Dysentery.

The symptoms of this disease vary very greatly, depending on the acuteness and severity of the infection. In the mild bacillary dysentery there may only be some diarrhœa with the passage of liquid stools containing a slight amount of mucus, the whole condition persisting for only two or three days and passing off with rest and limitation of diet. This mild type is often due to an infection with the Flexner or Sonne bacillus and very frequently attacks foreigners shortly after their arrival in this country. It is often not diagnosed as dysentery, but recent investigations have shown that a cultural examination of the stools in such cases will very frequently demonstrate that a dysentery bacillus is responsible for this intestinal upset.

Severe attacks of bacillary dysentery are, however, very common and this type of the disease may run a very acute and severe course. The onset is often extremely acute, perhaps waking the patient up at night

[1] Post-graduate lecture delivered at Kasr-el-Aini Hospital on March 24, 1930.

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with an urgent desire to empty the bowels; the stools may be very frequent, the motions being accompanied by very marked tenesmus and griping Fever is usually present and occasionally vomiting may take place; if the case is going to run a favourable course, the stools gradually become less frequent and the amount of blood and mucus diminishes, convalescence slowly taking place. In the more severe fulminating cases however the patient becomes markedly toxic and collapsed and the temperature is often subnormal. The stools may become offensive in odour and assume a dark appearance like meat washings, mucus being absent owing to the complete destruction of the mucus secreting goblet cells in the colon by the dysentery toxins. An intestinal discharge of this nature indicates a very severe and extensive bowel lesion and a correspondingly bad prognosis. The number of stools passed may become uncountable in these severe cases. Palpation of the abdomen elicits great tenderness especially in the sigmoid region where the colon can be felt contracted and rigid; frequently, however, the whole length of the large intestine will be markedly tender.

Blood examination usually shows a moderate degree of leucocytosis.

Occasionally a case of typhoid fever with involvement of the large intestine may commence with a sudden onset of blood and mucus in the stools accompanied by fever, resembling very closely a case of dysentery, but the true nature of the condition is usually soon suspected owing to the temperature persisting longer than it would in a case of bacillary dysentery. In such a case Widal and other investigations give one the correct diagnosis.

Amœbic Dysentery.

The symptoms in this type of dysentery are usually gradual in onset, with diarrhœa and some blood and mucus. Tenesmus may be a marked feature when the condition is acute with ulcerations extending low down into the rectum, or there may be little or no anal discomfort where the ulcers are situated high up in the large intestine. The appearance of the stools usually differs from that of an acute bacillary case in that they may contain much fæcal matter mixed with the blood and mucus and have usually a more offensive odour. Occasionally, however, we meet with a case of amœbic dysentery, in which the onset is extremely acute, simulating very closely an acute bacillary infection, the stools being entirely composed of blood and mucus and very numerous. The stools in this type of amœbic dysentery are often extremely offensive in odour due to the presence of extensive gangrene of the mucous membrane of the gut. The abdominal tenderness which, in amœbic dysentery, is usually most marked in the cæcal region may in these very acute cases extend along the whole length of the large intestine. In this fulminating type of amœbic dysentery, simulating extremely closely a case of bacillary infection, the difficulty in diagnosis is increased by the fact that entamœbæ are frequently absent from the stools passed by the patient owing to their having been destroyed by the

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superadded pyogenic infection present in the intestine, the entamœbæ being very easily killed by these organisms and so rendered unrecognizable. I have known of such an amœbic case being treated as a bacillary dysentery owing to the presence of many pus cells in the exudate suggesting a bacillary infection, and to the fact that no entamœbæ could be discovered on repeated examinations of the patient's stools, the polymorph cytology and absence of entamœbæ being due to the superadded pyogenic infection. A short history of such a case might be of interest :—

The patient, a female, aged 25, was admitted complaining of the sudden onset of diarrhœa with blood and mucus and tenesmus, the onset having occurred seven days previously. The patient looked toxic on admission, the tongue was furred, temperature 38° C., pulse 110. Examination of the abdomen which was retracted elicited tenderness all along the length of the large intestine. The motions were extremely numerous and consisted of pure blood and mucus. The cytology showed large numbers of polymorphs and an absence of entamœbæ on repeated examinations. Stool culture failed to isolate any causative organism. The case was considered to be one of bacillary dysentery and was treated as such. She did not improve and died four days after admission. The post-mortem examination revealed a marked condition of amœbic dysentery with extensive patchy amœbic ulcers extending along the whole length of the colon. The mucosa between the ulcers was healthy, this healthy appearance excluding the presence of a mixed bacillary and amœbic infection. This was one of the cases that convinced me that we must employ some more accurate method of diagnosis if similar catastrophies are to be avoided in future and led to our undertaking sigmoidoscopic examinations as a routine in dealing with dysenteric conditions. Since employing this instrument many similar pitfalls in diagnosis have been avoided.

Bilharzial Dysentery.

This disease may begin very acutely with the passage of frequent stools resembling closely the onset of a case of bacillary dysentery. Many such cases have been met with by us, but the more usual onset is gradual and very closely simulates that of dysentery due to an amœbic infection. Digital examination of the rectum in the stage of infection associated with papilloma formation may allow of a diagnosis being made by the detection of these masses low down in the rectum, but not infrequently the deposits are not within reach of the finger, and then one has to depend for a diagnosis on the discovery of the ova in the fæces. Ova occasionally are absent from the fæces even after sedimentation methods have been employed, and here the diagnosis cannot be made without viewing the affected area through the sigmoidoscope.

Balantidium Dysentery.

Balantidium coli is frequently present in the intestine without causing any symptoms, but Dobel and Low consider that the invasion of the tissues

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by *Balantidium coli* may produce a chronic ulceration resembling amœbic ulcers with corresponding symptoms. We have not found any cases of dysentery resulting from this infection alone, but not infrequently it has been found associated with one or other of the definitely accepted causes of dysentery.

Malarial Dysentery.

During a recent investigation of a series of cases of subtertian malaria we found that a certain number of these cases developed diarrhœa varying from simple watery diarrhœa, to intense diarrhœa associated with the passage of blood and mucus and the presence of tenesmus. A thorough investigation of these cases was made, all the usual causes of dysentery in Egypt being excluded. Treatment with plasmochin compound was carried out and the symptoms were found to clear up more quickly than could have been expected had the conditions been due to any other cause than the well-recognized malaria involvement of the vessels of the intestine.

The Accurate Diagnosis of Dysenteric Conditions.

If treatment is to be properly applied it is essential that as soon as the patient comes under observation the correct diagnosis of the type of dysentery from which he is suffering shall be made. While the general clinical state of the patient may be of considerable assistance in arriving at a diagnosis, this method alone will frequently lead to errors. Laboratory examination of the stools is an important step in the investigation of these cases, repeated examination frequently being necessary before one can determine with certainty which type of infection is present. There are, however, certain points that must be remembered in carrying out investigations.

The stools must be fresh, free from urine and antiseptic and passed in a dry bed-pan; *the examination of a stale stool is only a waste of time.* A fresh specimen can often be obtained by means of a soft rubber catheter inserted into the anal canal and twisted round several times, sufficient mucus for examination thus being obtained from the eye of the catheter. When necessary we now get our specimens by means of a Volkmann spoon passed through the sigmoidoscope.

The naked-eye appearance of the stools in bacillary cases varies considerably, but typically they are inoffensive, composed almost entirely of sticky bright blood and mucus with little or no fæcal matter. In amœbic cases there may be simple diarrhœa with very little blood or mucus, but occasionally blood and mucus may be so abundant as to form almost the entire bulk of the motion, and then it is indistinguishable by the naked eye from a bacillary stool; usually the amœbic stool is more offensive in odour than the bacillary.

The reaction of the fresh stool may be of assistance, an acute bacillary one being usually strongly alkaline to litmus, whilst an amœbic stool is usually acid; this statement does not always, however, hold good.

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The microscopic examination of a fresh warm normal saline emulsion of a carefully selected part of the motion containing blood and mucus is often of the utmost importance in assisting in arriving at a diagnosis from the cytological appearance of the stools. The saline should not be too warm, otherwise entamœbæ may be rendered immobile. I have observed this to occur during the examination for *Entamœba histolytica*, only immobile entamœbæ being found due to too hot saline having been used. The emulsion should not be too thick and should allow of printed matter being easily read through it. Contrary to the usual routine of examining specimens first with the low power of the microscope, I usually commence with the $\frac{1}{6}$-inch lens to examine for the cytology and presence of entamœbæ, by this procedure one gets the amœbæ if present warmer and more motile (a warm stage is very useful in the winter months). It is essential, however, that a $\frac{2}{3}$-inch power should be used during the examination to enable one to get a general look round and exclude the presence of bilharzia ova, etc. Those may be missed by an examination with the high power alone.

I accept only the presence of mobile *E. histolytica* as a definite proof of an amœbic dysentery infection, cysts not being considered sufficiently diagnostic. In bilharzia infections free swimming miracidia may occasionally be seen instead of, or as well as, bilharzia ova; these may be mistaken for *Balantidium coli* by the inexperienced.

Characteristic Cellular Exudate of the Stool.

In amœbic cases the cellular exudate is usually scanty with a few degenerated polymorphs; clumps of red blood-cells are often seen adherent to each other, these degenerative changes being produced by the action of the proteolytic ferment secreted by the entamœbæ.

The cytological appearances in a case of acute bacillary dysentery usually differ entirely from those of an amœbic case. The stool is full of cells, ninety per cent of these being polymorphs with well preserved nuclei and margins. Large macrophage cells, which are hyaline mononuclear cells derived from the endothelial cells of the capillaries or wandering plasma cells, are also present, they have a prominent oval nucleus and often contain remains of ingested material. They are very sluggishly motile, the movement being hardly apparent to the eye; these macrophage cells have frequently been mistaken for dead *E. histolytica*. I consider immobile amœba-like bodies in a saline specimen should never be accepted as *E. histolytica*. Unaltered red blood-cells are present lying discrete in the emulsion. Ghost cells are frequently seen, having an outline but no internal structure. Only very scanty bacteria are found in the discharge from an early case of bacillary dysentery, whereas in the amœbic type bacteria may be plentiful.

The appearance of the bacillary dysentery stool depends to a large extent on:—

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(*a*) *The Specific Organism Concerned.*—In mild Flexner infections it is not infrequently fæculent and contains only a few cells, thus differing entirely from that in a more acute bacillary case.

(*b*) *The Stage of the Disease.*—This is most important as it is *only in the first few days of the bacillary dysentery infection that a typical cytology can be expected.*

Manson-Bahr and Perry give the cytology as follows :—

Stage 1.—First three days of the disease, preponderance of well-preserved polymorphs, fresh red blood-cells, macrophages, and few visible organisms.

Stage 2.—Fourth to seventh day of the disease, disintegrated pus cells, red corpuscles and macrophages, many motile bacilli being now seen. In still later stages of the diseases the stool becomes even less characteristic. In bacillary dysentery, as the acute process subsides, secondary intestinal protozoal parasites are often seen, such as *E. coli*, *Trichomonas hominis* and *Giardia intestinalis.*

During the convalescence of an amœbic case Charcot-Leyden crystals are frequently seen ; they are sharp whetstone shaped, clear, greenish, refractile crystals, products of tissue disintegration caused by the *E. histolytica.* Some consider these almost pathognomonic of chronic amœbic infection and if found along with entamœbæ they state that the infection must be a long-standing one. We have not found these crystals to be of much value in assisting in a diagnosis of amœbic dysentery infection.

During the later phases of amœbic ulcers, secondary infection with streptococci or other pyogenic bacteria may be abundant and then *E. histolytica* may be found in a stool rich in cellular exudate full of polymorphs like a bacillary exudate ; in these cases the nature of the cytology does not help in the diagnosis. Sometimes this pyogenic infection destroys entirely the entamœbæ free in the bowel cavity and so renders their detection impossible. In these cases, however, numerous actively motile entamœbæ can always be demonstrated in material obtained by a Volkmann spoon, taking a specimen from the deeper parts of the ulcers where the pyogenic bacteria have not been able to penetrate.

Description of the Vegetative Forms of Entamœba histolytica.—Living motile *E. histolytica* are only found in fresh warm stools, they are usually about 20 to 30 microns in size. One third of the cytoplasm is a clear translucent highly refractile ectoplasm and two-thirds is composed of finely granular endoplasm. When very fresh, the entamœba flows in a straight line extended like a slug, its anterior end being clear ectoplasm. It usually contains red blood-cells, these flow about and roll over one another with each movement of the entamœba. I have frequently seen, on glancing down the microscope, a collection of red blood-cells moving across the field and only after another look has it become evident that these red cells were contained inside an active entamœba. Occasionally actively motile *E. histolytica* are seen with no red cells inside, their absence only indicates

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that the amœba has not recently ingested any red cells and does not by any means imply that the motile amœba is not a true *E. histolytica*.

This active movement across the slide, seen in the very fresh specimens, soon ceases, being replaced by the projection of blind pseudopodia with clear hyaline ectoplasm absolutely characteristic of *E. histolytica*; when the movement is sluggish they can often be rendered more active by warming the fæces in an incubator at 37° C. for two to three hours, after which active motility may be observed. When bacteria invade an entamœba it rapidly dies and becomes a motionless mass of protoplasm, and it then becomes quite unrecognizable.

Cultural methods for E. histolytica on special media have been recommended and investigations are at present being undertaken on these lines by Dr. Omar and Dr. Gohar. Some investigators consider that before a histolytica cyst can be made to develop in a culture medium it must be exposed to cold and kept for some time, this being a necessary stage for its development; others believe this cooling not to be necessary. The culture medium used here at present in Kasr-el-Aini Hospital is solidified Dorset egg slopes covered by Locke's solution.

Culture of Bacillary Organisms.—It is essential if a positive result is to be expected in bacillary dysentery to have a fresh specimen within the first few days of the commencement of the diseases. Manson-Bahr and Perry state that the specific organisms of bacillary dysentery are hardly ever recovered from the stools after the sixth day of the disease; even suitable stools obtained early in an attack sometimes fail to yield a positive culture, therefore *a negative stool report does not by any means exclude the possibility* of the case being one of bacillary dysentery. On the other hand, the isolation of an organism of the bacillary dysentery variety does not necessarily prove that the patient is suffering from an active infection with this organism, as not infrequently a dysentery bacillus has been isolated in the laboratory from a case where the sigmoidoscope has shown only amœbic lesions, the presence of these organisms possibly being accounted for by the patient being a bacillary dysentery carrier. A little urine in the bed-pan may be sufficient to inhibit the growth of the bacilli. Where no laboratory is at hand the specimen can be forwarded for examination for dysentery bacilli to one at a distance by emulsifying one part of fæces with two parts of thirty per cent glycerine in sterile 0·6 per cent saline; this solution however, rapidly destroys *E. histolytica*.

The Serological Diagnosis of Bacillary Dysentery.—There is considerable difference of opinion as to the value of this method in the diagnosis of bacillary dysentery, i.e., the method of testing the agglutinating power of the patient's serum against a known strain of dysentery bacilli. Some observers consider that a positive agglutination of 1 in 25 for Shiga, and 1 in 50 for Flexner is diagnostic. These agglutinins do not develop in the blood in sufficient quantities to be of much value for diagnosis before the eleventh day of the disease. A previous attack of bacillary dysentery may

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leave agglutinins in the blood for three and a half years afterwards, so interfering with the value of this test. We have not found this serological method to be of any use in assisting in the diagnosis of bacillary dysentery, even cases proved bacteriologically frequently failing to show any agglutinins during convalescence from the disease.

The diagnosis of chronic bacillary dysentery is extremely difficult, far more so than the diagnosis of the acute condition. It calls for the utmost diligence and skill of the physician and laboratory worker. The radiologist may be of assistance in excluding other causes for the symptoms, such as carcinoma of the intestine, etc. The radiological appearances of the colon after a barium meal are considered by some to be of value in the diagnosis of the dysenteric conditions, the ulcers sometimes showing up and spasmodic conditions of the colon being revealed. The microscopic appearance of the stool is not characteristic at this late stage in the disease, secondary infection with *B. pyocaneus*, *B. fæcalis alkaligenes*, etc., having completely changed the cytological picture.

The diagnosis of chronic amœbic cases may also be very difficult, the symptoms being very varied, with sometimes only irregularity of the bowels such as diarrhœa and constipation with mucus in the stools; occasionally colicky pains and localized pains on the appendix region may be present, simulating a chronic appendicitis. Indigestion may be the chief complaint, or occasionally symptoms suggestive of neurasthenia or hepatitis are the most prominent. We have found in these chronic cases of amœbic dysentery that a very common site for a typical ulcer is just inside the internal sphincter. This ulcer is probably produced by the entamœbae from higher up in the colon which are held up at this place and so allowed to gain access to the submucosa. In these cases repeated stool examinations may be negative for entamœba, and a sigmoidoscopic examination may be the only means of arriving at a diagnosis.

Mixed infections should always be excluded, other causes for dysentery being searched for even though one causal factor has already been discovered. In Egypt it is quite common to find infection with a combination of bacillary and amœbic or bilharzia dysentery, and in one case examined by us all three factors were found at work at the same time, the sigmoidoscope revealing a bilharzia papilloma, typical discrete amœbic ulcers, and the remaining mucous membrane being diffusely inflamed by a bacillary dysentery infection.

Conclusions.

From the above considerations it will easily be understood how difficult it frequently is to arrive at a correct diagnosis as to the ætiology of the dysenteric condition, especially in cases of bacillary dysentery, where the patient often arrives too late to allow of the specific organisms being isolated by the laboratory, and too late for the cytological examination of the stools to be of any aid in the diagnosis. In amœbic cases difficulties in diagnosis

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have frequently also been experienced owing to the entamœbæ not being demonstrated even after repeated examinations of the stools, the pyogenic organisms present having killed them and so rendered them unrecognizable.

In bilharzia cases also occasionally no free ova are found in the stools, this making a definite diagnosis impossible without some further method of investigation such as viewing the interior of the gut. These difficulties in the diagnosis of our cases have compelled us to find some further method to assist us in arriving at a diagnosis, and this necessary aid we have obtained by the use of the sigmoidoscope.

The appearance of the lesions of amœbic, bacillary and bilharzia dysentery seen through the sigmoidoscope are very characteristic and a view of these lesions usually allows of an accurate diagnosis being made and the specific treatment being commenced at once. The sigmoidoscope also has allowed us to control the effects of treatment by various drugs in a very accurate manner.

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MY AMERICAN TRIP.

By Lieutenant-Colonel M. B. H. RITCHIE, D.S.O., O.B.E.,
Royal Army Medical Corps.

In 1929 I was fortunate enough to be selected to represent the Medical Services of the Royal Navy, Army and Royal Air Force at the Annual Convention of the Association of Military Surgeons of the United States. The Convention was held at Denver, Colorado, at the end of September.

I had a pleasant voyage out on the White Star liner "Laurentic." Though at the busy season of the year, the ship was not crowded, and my fellow-voyagers were friendly and interesting. We had coldish, rough weather and a good deal of fog. Over the rail one looked out on a hundred yards of angry, grey ocean, and that was all there was to it. The siren kept going at intervals, and the pace was slackened. Very different from a Mediterranean trip, thought I. But if outwardly dull, the ship was gay aboard; cinemas, races, meetings, dances, and a gymnasium—the latter a joy which one cannot experience on a trooper. You can spend the whole day, if you want, rowing, biking up hill or on the flat, and lamming into a punching-ball. Then you go for a long ride on a confidential hack who will trot, canter and gallop, if you use the switch on him. But the switch is the kind that turns the current off and on.

Presently we made the Straits of Belleisle and sailed up the mighty St. Lawrence. It is a wonderful trip, through smiling country dotted with French villages, past the historic and picturesque city of Quebec. Wolfe and his lads had an incredibly steep climb up one of the most inaccessible paths that a British force ever scaled when he defeated de Montcalm in 1759. Montreal came in view at night, its great cross on the mountain looking superb, and the *aurora borealis* in full force over the lights of a vast, modern city. I was met there by a distinguished officer of the Canadian R.A.M.C., now Director-General, who has a host of friends in the Corps at home, Colonel J. T. Clarke. He was exceedingly kind to me, and helped me on my way to Denver. I also met an old friend, very well known in the Corps, Sir Henry Gray; he swept me off to the golf links, a delightful course, many miles out, where I met many delightful people.

Travel is agreeable over there; you have a comfortable berth and an excellent dining car. For three nights I was trundled over the railroad, mighty hot by day, past cities and towns and interminable vistas of agricultural country, as flat as a pancake, until one morning the hills appeared in the distance and I found myself in Denver. I arrived the day before the Convention opened, and immediately dashed up into the Rocky Mountains. A motor car takes you up over 10,000 feet, on perfectly-engineered roads. They are first cousins to the Himalayas, and very grand. The scenery is superb.

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The Annual Convention.

The Convention began on September 26, with an address of welcome from the Mayor of Denver. The President of the Association then delivered his address. The Foreign Delegates were introduced in turn, according to rank, and presented with the Honorary Membership and badge of the Association. In addition to myself, the foreign delegates were : Colonel D. M. Velez, Mexico ; Colonel C. A. Zevallos, Peru ; Colonel K. H. Chen, China ; Major G. Pirelli, Italy ; and General P. N. Coryllos, Greece.

At this inaugural meeting I read out Greetings to the Association from the British Medical Services, which were very kindly received by all members of the Association. Colonel Velez presented a Mexican flag to the Association, and honorary membership badges to several distinguished Americans on behalf of the Mexican Association of Military Surgeons. The members of the Convention proceeded by car to the new Air Port of Denver, and saw a flying display by the Colorado National Guard Air Service. A paper on Aviation Medicine, with demonstration and discussions, was read by Dr. L. H. Bauer, Chief of the Medical Aviation Section, Department of Commerce.

On the 27th the Convention met at the Fitzsimmons General Hospital, a few miles outside the city. This is a Military Tuberculosis Hospital for soldiers and pensioners, named after the first medical officer to fall in the late War, Lieutenant Fitzsimmons, attached to the British Army in France. The work here is on the lines of Rollier's work at Leysin, Switzerland. The papers and demonstrations at this meeting were of high order. Heliotherapy and thoracoplasty were the principal subjects. Lieutenant-Colonel E. H. Bruns and Captain H. V. Raycroft conducted the demonstrations.

The international aspects of military medicine were dealt with by Colonel G. E. Seaman. In the evening a banquet in honour of the foreign delegates was given. I spoke on Anglo-American relations and international co-operation in the medical services.

On the 28th the Convention attended a review of the Highlander Boys Regiment of Denver. This is a well-endowed organization of boys between the ages of 8 and 13, about 1,200 strong, corresponding to the "Wolf Cubs" in this country. The ideals and training are similar to the "Cubs," and the Regiment "feeds" the Boy Scouts. On parade, it is organized as an American infantry regiment, with a large and efficient band. The boys were dressed in white, like American sailors, carrying small guns. Officers are Boy Scouts in the uniform of naval officers. They marched past, and afterwards did physical drill with arms, to music. The effect was impressive.

The rest of the day was taken up with a motor drive through the Rocky Mountains, visiting Idaho Springs, Buffalo Bill's grave on Lookout Mountain, and a gold mine. This concluded the Convention, which began to disperse the same evening.

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Chicago.

I arrived at Chicago on the morning of October 30. Lieutenant-Colonel G. Fitzpatrick, who was at the Convention, had very kindly arranged a programme for me. I was taken to the offices of the American Medical Association, where I met Dr. J. M. Dodson, the Secretary.

He showed me over the building, which contains a very fine collection of exhibits, and explained to me the activities of the Association, which are much wider than those of the British Medical Association. I found him not only glad to discuss these activities, but most interesting and shrewd in his views of the administrative aspects of the profession. I was taken over the buildings of the North-Western Hospital and Medical School. I was much impressed by the excellent study facilities with which the American medical student is provided. After a visit to the headquarters of the American surgeons, I was entertained to lunch by Colonel Fitzpatrick, and met the British Consul-General.

In the afternoon I was shown over the offices of the Health Commissioner of Chicago. I had the opportunity of discussing with several of the Medical Officers of Health the preventive measures in force in that city, the epidemiological work, and water purification, which is by chlorination, the drinking water being taken direct from Lake Michigan.

New York.

I had a look at Niagara Falls on the way to New York, where Commander Bainbridge, well known in connection with the International Congresses and possessing a host of friends in our own medical services, had kindly arranged a most interesting programme for Colonel Chen, the delegate from China, and myself. I attended a banquet in honour of the Italian delegate, Major Pirelli, a distinguished *confrère* and a charming personality, whom many readers met in London last May. I felt it fortunate that I happened to have a long continued acquaintance with Italy, and when called upon to speak I had an opportunity of expressing my admiration for things Italian and Anglo-Italian relations. The next day we had a very full programme. I saw the Naval Hospital and Supply Stores, and met several very friendly and courteous naval surgeons. Then after a very sumptuous lunch we went to Columbia University. I was deeply interested in Dr. McCastline's work there; he and his assistants are making an accurate record of the state of health of every student that enters. This is far more complete than an examination of recruits. He is getting together and sifting out a mass of most important health data that will be of supreme interest.

From there we visited the new Presbyterian Hospital, at the recently created Medical Centre for New York. All the hospitals are to be grouped together in one site, and the Presbyterian Hospital is the last word in hospital construction and equipment, 900 beds and fifteen stories high. Mr. Maynard, the Superintendent, took me over the building from top to

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bottom and I saw everything I could; it fairly opened my eyes to the administrative experience that can be picked up in one of these super-hospitals, working every day at high pressure.

Next day we called on the General commanding the Corps area and the Corps Surgeon. The garrison of New York is located at Governor's Island, a charming old-world spot, with delightful colonial houses, in sharp contrast to the sky-scrapers over the way. Major Ralph Devoe took me round the barracks, and I had the unique opportunity of going round a portion of them with the M.O. doing his weekly Saturday morning inspection. I met several infantry officers and had a nice long chat with them on equipment and interior economy. They were very interested to hear about our equipment and system of messing. Generally speaking, hygiene standards are similar to ours. In some ways the American soldier is better provided for. The rooms have central heating and each soldier has a locked metal wardrobe in which he keeps his clothing. His uniform, etc., is thus hung up on coat-hangers and there are no clothes near his bed; his barrack-room cannot get an "old clothes shop" appearance if he is tidy.

Personal equipment, i.e., pack, water-bottle, etc., is kept together in a locked room, ready packed. The company can thus file through and each man put on his full marching order in a very short space of time. The equipment is very similar to ours but does not require constant cleaning or polishing.

Lavatories, on the whole, are better than in our older barracks; they are larger, with more wash-hand basins, hot and cold water, and several shower baths. The ordinary type of bath did not seem to be much in use.

The system of messing seems to be on our lines; the ration, which costs approximately two shillings per head per day, is larger. The menus are much more elaborate than ours, and the variety of food is greater. The company store-room which I saw contained an array of tinned articles of diet which resembled a steward's store of a hospital. Each store room has its refrigerator.

Breakfast.—Oranges, shredded wheat, hot cakes, fried bacon, butter and syrup, coffee and milk.

Dinner.—Baked ham, brown gravy, mashed potatoes, cream corn, bread pudding, bread and butter, coffee and milk.

Supper.—Hamburger steak, brown gravy, fried potatoes, sliced tomatoes, sliced peaches, bread and butter, coffee and milk.

I spent a day at the Manhattan State Hospital, and left for Washington at night. The Hospital is a large mental hospital on an island, and was in charge of the late Dr. Floyd Havilland. Some of the nursing staff are British. The administration of this hospita was very interesting. Treatment of "border line" cases is on very modern lines, and I was struck by the administrative and professional efficiency which prevails in this institution. For the opportunity to visit these places in New York I am deeply indebted to Commander W. S. Bainbridge.

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WASHINGTON.

I arrived at Washington on the morning of October 8 and stayed at the Army and Navy Club, through the courtesy of the Medical Corps. Colonel J. R. Kean, the Secretary of the Association of Military Surgeons, called for me and took me to meet Surgeon-General Ireland and his Staff. I found the Surgeon-General very charming and kind to me. He invited me to a lunch party that he was giving in honour of General Keefer, the retiring assistant to the Surgeon-General. I had the honour of sitting on General Ireland's right.

I called on General Gilchrist, the Chief of the Chemical Warfare Service, whose appointment to this important post has given satisfaction to the Medical Corps, of which he is a member. He commanded No. 9 General Hospital (British) during the War. He showed me over his department—it is interesting to note that each service or arm of the American Army is administered in a "compartment" of its own. In this case, in his office are personnel who deal with administrative matters for the Chemical Warfare Service, including pay questions.

On October 9 I was shown over the Army Medical Museum by Colonel Kean. I saw the Walter Reed Hospital and Army Medical School. Major Denit, one of the Surgeon General's staff officers, very kindly drove me there. The Walter Reed Hospital is of 900 beds and still in process of building. It takes as patients both pensioners and soldiers, and receives cases from considerable distances. It is amply staffed. There is a great deal of accommodation for sick officers in single-bed wards, well furnished and well found. Lavatory arrangements are similar to those of a first-class hotel. As in other hospitals, appliances for keeping food warm, in trolleys or "hot cases," are in constant use. In this particular aspect the American hospitals are ahead of ours. Meals are served very daintily on the usual type of bed tray, and menus are elaborate. The officers' ward has a kitchen of its own with many labour-saving devices. In spite of these, the staff of sisters, orderlies and wardmaids is considerable. One may say that, as a general rule, both in civil and military hospitals, the staffs of doctors, sisters and attendants are larger than in British hospitals.[1] A workshop is established at the Walter Reed Hospital, and classes in various kinds of handicrafts are held.

The Army Medical School stands in the same grounds. I met Colonel H. C. Fisher, the Commandant, and several officers. The School is elaborately equipped with laboratories and lecture rooms. The staff consists of thirty-one officers, directors or instructors. The basic course, for officers on joining, lasts four months. The subjects are—Preventive Medicine, Surgery, Roentgenology, Ophthalmology and Oto-rhino-laryngology, Aviation Medicine and Chemical Warfare.

The staff of the School were keenly interested in our work at Millbank.

[1] This is a point to remember in this present epoch of economy. Our American cousins have seen that personnel cannot be "skimped."

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Baltimore.

Next day, October 10, I went to Baltimore, where I had the opportunity of seeing the work of the Maryland National Guard Medical Regiment, through the kindness of Colonel F. H. Vinup, commanding. This corresponds to the combined Field Ambulances and Field Hygiene Section of a British Territorial Division. It was the weekly training evening, and I had the opportunity of meeting Colonel Vinup's officers and seeing the men at instruction. The armoury, or drill hall, of the regiment is a large building with a great deal of accommodation. I was interested to see the equipment which a medical regiment possesses. These National Guard units have all their equipment with them, not only medical, but tentage for the sick and for the personnel. The whole equipment that the regiment would take with it on mobilization is complete and in constant use. Though not of the new design, it is extremely serviceable. There seems less need in America for careful safeguarding of stores, and one's impression is that replacements must be a simple matter, and checking less meticulous, than on this side of the Atlantic. At any rate, the men have abundant opportunity to handle and become familiar with the equipment which they would use on service. In addition to field equipment, there is a medical store for replenishment.

Medical Field Service School, Carlisle.

On October 12 I was met in Harrisburg and driven out to the Medical Field Service School at Carlisle, some twenty-two miles off. This was one of the most interesting places I saw during my visit. The School is a series of separate blocks, with trees and lawns, and a large camping ground outside, where National Guard Medical Units carry out their annual training. I was received by Colonel C. R. Reynolds on my arrival, and introduced to the officers. A class of officers had just finished a course and was on the point of dispersing.

The Medical Regiment was on parade with band and colours. I stood at the saluting base on Colonel Reynolds' right, with a colonel on my right, as the regiment marched past. The men carry rifles and the officers have drawn swords. Smartness and precision on parade were noticeable. At Colonel Reynolds' request, I addressed, in one of the big lecture rooms, a gathering of officers and N.C.O.s. I told them about our N.C.O.s and their training. He and the officers were kind enough to express their approval of my impromptu speech. I was taken over the various sections of the School. I was much interested in the correspondence courses of instruction, which are carried on for the benefit of the reserve and National Guard officers. Schemes are sent out, papers set, and these are corrected at the School. The barracks of the troops are well found, tidy, and very well ventilated. The Hygiene Section corresponds to our School of Hygiene with many of our models. The officer in charge of it has been to Aldershot and spoke very highly of what he had seen there.

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One of the most interesting sections of the School is the Experimental Laboratory. It is here that Major Fletcher has designed the new field equipment. This has already been described in this Journal. Major Fletcher has a genius for devising camp gear. Everything I saw was ingenious, simple, and serviceable. Everything is contained in metal boxes, like wardrobe trunks, and made very strong. The wheeled stretcher carriage is particularly serviceable and portable.

After I had been conducted round the buildings I went to the Commandant's office, where all the officers of the School filed past me and I shook hands with each in turn. This I regarded as a signal honour which they paid to a representative of the Royal Army Medical Corps. At lunch in the Officers' Club, Colonel Reynolds and the officers were very friendly, informal and keen to know about our outlook and activities. They are very earnest in their work and deeply interested in it.

Ottawa.

From Harrisburg I went to Ottawa, by Toronto, arriving on the morning of October 14. Colonel Jacques, the Director-General of the Canadian Army Medical Services, received me very kindly. He took me personally to see the Chief of the General Staff, Major-General McNaughton, and the Adjutant-General, Major-General Panet. Being in the non-training season, I was unable to see any Canadian Medical Units. I was able, however, to discuss many points of interest with Colonel Jacques and his Deputy Director-General, Lieutenant-Colonel Dickson, and I was much impressed with the enthusiasm with which the training of officers is carried out. It was a great pleasure to have the opportunity of meeting these officers, particularly so as I seem to have been the first officer of the R.A.M.C. to pay a visit to the Defence Ministry for some considerable time.

I was entertained to lunch, and to dinner at a country club near Ottawa and had the pleasure of meeting Colonel Miller, Director of Medical Services of the Pensions Ministry, who served with the Canadians in France.

On the 15th I lunched at Government House with Lord and Lady Willingdon, and left early next morning for Montreal. Colonel Clarke again very kindly met me. I had another round of golf with Sir Henry Gray and embarked on s.s. "Calgaric" that evening, sailing at daybreak on October 17. I disembarked at Southampton on October 25.

General Impressions.

I managed to visit a large number of places in a limited time, by travelling at night and arranging my programme ahead. By visiting Washington, New York, Baltimore and Carlisle, I was able to see the work and scope of the Medical Corps, and to know intimately a large number of American medical officers of all ranks and branches. Many remembered some of our officers during the War. American medical men seem to visit

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this country frequently. They know our leading specialists, and our bigger hospitals, but they have little contact with the R.A.M.C., save at the International Congresses. The visit of an R.A.M.C. officer to the Surgeon General, the Army Medical School, and the Medical Field Service School, provided an opportunity to give expression to that sense of hospitality, friendliness and comradeship which the American people possess. It was not only that I was treated with politeness and consideration, I was welcomed as a friend and comrade everywhere, sometimes informally, sometimes with much formality. But all through they were welcoming, not an individual, but a representative of the Royal Army Medical Corps. Our activities have been studied, and many of them taken up. In some cases, as in the training at the Medical Field Service School, they have been able to go beyond our range owing, probably, to less financial stringency.

The American Medical Officer.

I was particularly struck by the keenness among all ranks of officers of the Medical Corps. Pay by corresponding ranks in our service is slightly higher, but not quite enough in comparison with higher costs of living. It is expected to be raised soon. Promotion to Lieutenant-Colonel is at twenty years, to Colonel at twenty-six years; to General Officer, however, there are only a few vacancies. Except for ill-health or other causes, there is no pension until thirty years' service. Foreign service forms a small proportion of total service; tours are of three years' duration. As a rule, an officer remains for three or four years in one station.

Medical officers may attend the War College at Washington, corresponding to our Staff College. The course lasts a year. This seems to be the goal of many keen men I met. Medical officers' hours of work are from 9 a.m. to 4.30 p.m., with one afternoon off a week, in addition to Sundays. Leave does not appear to be taken or desired to the extent it is allowed in the British Army. Instead of a mess there is an Officers' Club in most stations (i.e., posts) which corresponds to a garrison, not a regimental mess. Single officers and many married officers have their meals there. Married quarters are the rule more than the exception.

The general impression I gained was one of efficiency and active-mindedness. Individuals show by their conversation that they possess good professional and administrative knowledge. The men I met were well read and up-to-date in their medical and general outlook. The Medical Corps, I understand, has been given a fresh stimulus since the War, and is now on a good footing. The status of medical officers, in relation to other branches and to the civil profession, is highly satisfactory.

The Medical Service of an Infantry Division.

The Medical Service of a Division is called a "Medical Regiment" and corresponds in numbers to the three Field Ambulances, Hygiene Section and Mobile Veterinary Section. (In the U.S. Army, the Veterinary

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Service forms part of the Medical Service.) The A.D.M.S. is a Colonel, called the Divisional Surgeon, who has six officers attached, i.e., Medical Inspector, Urology and Gas Officer, Neuro-psychologist, Div. Dental Surgeon, Div. Veterinary Surgeon, and Director of the Laboratory Service.

The regimental headquarters (the Divisional Surgeon is also O.C.) has five officers, including Adjutant and Chaplain. The regiment is composed of:—

(*a*) *Collecting Battalion.*—H.Q., and three Collecting Companies.
(*b*) *Ambulance Battalion.*—H.Q. and two Ambulance Companies.
(*c*) *Hospital Battalion.*—H.Q. and three Hospital Companies.
(*d*) *Service Company.*
(*e*) *Medical Supply Section.*
(*f*) *General Supply Section.*
(*g*) *Medical Laboratory Section.*
(*h*) *Veterinary Company.*

I feel that I have not adequately expressed the deep sense of gratitude that I owe to the Medical Corps of the U.S. Army, and to a whole battalion of individuals, for the kindness and hospitality that I experienced. Colonel J. R. Kean and Major E. Erskine Hume, who look after the affairs of the Association, saw to it that everything was done for me, and I feel I have added both these charming men to my intimate friends for life. But when I begin to think of all these "pals" I made, all the kindly and thoughtful acts they did, all the talks I had on every subject under the sun, and all the good fellows who made me feel I was one of themselves and not a "foreign" delegate, well—I cannot just mention any names, because I would fill up a couple of issues of this Journal. And across the Canadian Border I met with the kindest of receptions from men that I must have rubbed shoulders with in many a Flanders village. How we did talk about the War, and all our mutual friends and "bosses"; I had to think hard of the medical "big noises" and tell my hosts what had happened to them all, and how they were faring. Truly, there is a spirit of *camaraderie* about the medical services of different nations that is unique among soldiers. Are we not a small League of Nations of our own?

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A DISCUSSION OF THE SYMPTOMS ASSOCIATED WITH A CEREBRAL TUMOUR AND NOTES ON A CASE.

By Major H. GALL,
Royal Army Medical Corps.

Lance-Serjeant F. W. was recently transferred to "D" Block, Netley, because he was said to believe that the pain in his head and neck was due to his wife's pregnancy, and had threatened to throw her out of the window. When he was examined the following points were noted. He denied his alleged delusions with irritation, and did not appear deluded. When sitting up he had a very irregular pulse, he also yawned and gave eructations. He complained of severe headache of some months' standing. He had vomited since admission more than once. The diagnosis of cerebral tumour suggested itself. He was rational, but dull and apathetic, with phases of irritability. The face was slightly asymmetrical, and this proved due to a lower neurone type of paresis of the left seventh nerve. The left eye on one or two occasions fleetingly turned inward, suggesting paresis of the left sixth nerve. There was elicited some abnormality of sensation in the area of the left fifth nerve, but no demonstrable paresis of the muscles supplied by its motor branch. He had double optic neuritis. He showed a tendency to deviate to the left in walking, but did so only once out of several tests at that examination. He did it once again a few days later, but denied that he ever did it. He had no nystagmus when sitting up, but when laid on his right side developed a horizontal and rotary nystagmus to the left. He once or twice showed a tendency to pass point to the left with the left forefinger. He was generally "shaky," largely owing to being weak and having been in bed; but no further definite neurological signs, in particular such as to implicate the left side of the cerebellum, were elicited. However, a tumour disturbing the left side of the cerebellum could be fairly confidently diagnosed, allowing for certain other possibilities, among them that of a secondary effect of a supra-tentorial tumour coming to exert pressure in the posterior fossa, as is always possible in late cases, such as this seemed to be.

The patient was shortly afterwards transferred to the Medical Division of the R.V. Hospital, *en route* for Millbank, but developed grave symptoms before he left Netley, and died with signs of medullary compression.

Autopsy, carried out by Major F. R. Coppinger, showed a softish, roughly bean-shaped tumour, about 1½ inches long, wedged in between the upper and lower lobes of the left half of the cerebellum. It almost fell out by its own weight when the brain was handled. The cavity it occupied is seen in fig. 1, wedged partly open by a piece of matchwood. The flattening of the cerebral convolutions due to the long-continued pressure is distinctly

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seen, as is also the dangerous "pressure cone" formed by the medulla and adjacent portion of the cerebellum which becomes wedged in cork-like fashion into the foramen magnum. Unfortunately, the tumour is not shown in the photograph. No doubt internal hydrocephalus was present, but the brain was not sliced because it was required intact for demonstration purposes at "D" Block.

This case illustrates the well-known tendency to compensation in cerebellar lesions. On the whole, the focal signs were slight and somewhat difficult to elicit. The valuable fifth, sixth, and seventh nerve symptoms

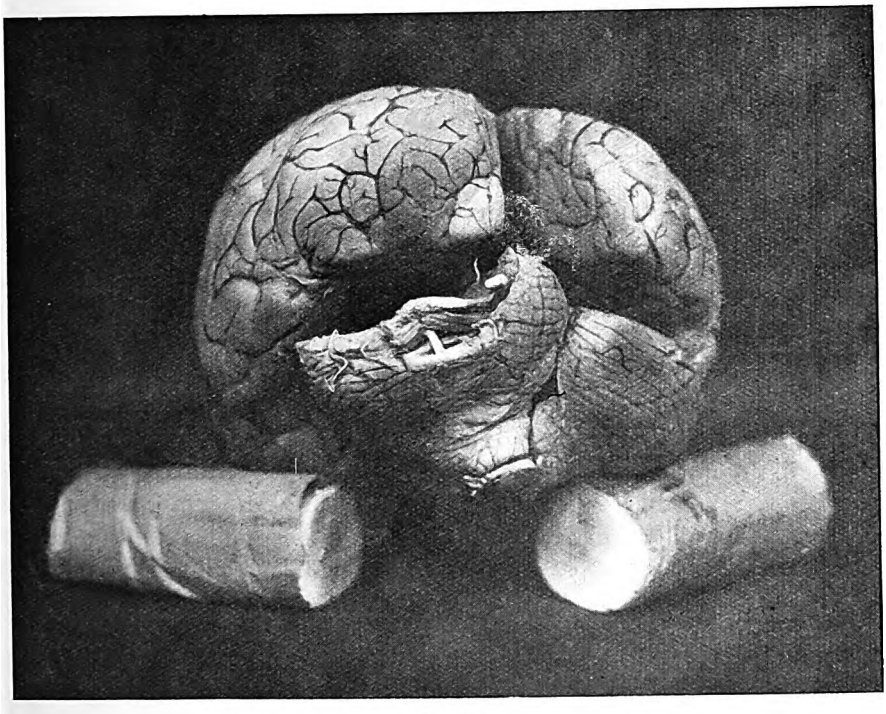


Fig. 1.

were doubtless due to compression or stretching of the nerve trunks, and were, of course, not cerebellar signs.

Some points arising from the symptoms of this case will now be briefly expanded.

Optic neuritis is of importance, not only for diagnosis when present, but also for estimating the rate of increase or decrease of the intracranial pressure. The actual amount of swelling should be measured at regular intervals, say fortnightly. A steady increase in the amount of "choking" points to the need of an early decompression in order to save regressive changes in the papilla, secondary optic atrophy and inevitable blindness, often the final tragedy of unrelieved cases. After a decompression, a steady

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decrease in the amount of swelling will indicate the success of the operation in giving at least temporary relief. The highest point of the swollen disc is measured in dioptres, and also the general level of the retina, the difference between them giving the nett swelling. Only measurements made by an ophthalmologist can be relied on, as the measurement is often a delicate and difficult one, and never easy. In this case the highest point of the left disc measured 4 D. and the general retina 0·5 D. That is to say, the disc was swollen 3·5 D. The right disc was 3 D.

As in this case, cerebellar nystagmus may be latent, and it may not suffice to examine for it only with the patient sitting upright or lying on his back. It is sometimes elicited by placing the patient in such postures as to cause a tumour to press or drag upon the brain. A readily aroused tendency to giddiness may also play some part here. Much work has been done on nystagmus in recent years, but the subject remains obscure. Nystagmus is essentially a conjugate deviation of the eyes, which is rhythmically corrected by a quick stroke in the opposite direction, and a nystagmus is named in accordance with the direction of the quick stroke. If the left eighth nerve of an animal with binocular vision be divided, there results a horizontal nystagmus (which also shows a rotary element) quick stroke to the right.

If, however, the left side of the cerebellum is disturbed, the nystagmus is to the left, or chiefly to the left, and nystagmus to the side of the lesion is here the rule. The case here recorded provides an example of this.

Thus, in spite of the close connections of the vestibule with the corresponding half of the cerebellum, vestibular and cerebellar nystagmus are opposite. If a lateral lobe cerebellar tumour comes to compress the eighth nerve, or the middle third of the brain stem, thus implicating the connections of the vestibular apparatus with the ocular nuclei, then a vestibular element may be added to the nystagmus and anomalous nystagmus may result which may prove misleading.

The fundamental element in a vestibular nystagmus is a strong definite conjugate deviation of the eyes to the side of the vestibular lesion. This is rhythmically corrected and nystagmus results.

Cerebellar nystagmus would appear to be due simply to unsteadiness of the muscles turning the eyes to the side of the lesion, so that the eyes tend to deviate back to the middle line.

Of practical importance is the view that the quick, return stroke of the nystagmus is governed by the cerebral cortex, for, in 1918, Dr. Isaac Jones of Philadelphia, in continuation of Continental and American studies, fitted this assumption into a scheme of localization in the brain which was based on the central connexions of the vestibular apparatus and which aroused great interest. It has besides been supported by other observers, i.e., Bartels and Rosenfeld. Among the arguments for this view is the fact that nystagmus cannot be induced by the usual caloric or turning tests in the anæsthetized subject, man or animal, but only the conjugate deviation

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component. The reason for this is considered to be that anæsthetics act with greater effect on the cortex than on the lower centres. If this view is correct, then a lesion involving the tract from the cerebral hemisphere to the posterior longitudinal bundle in the midbrain will prevent nystagmus, a point of importance in regard to localization.

Parinaud, and also it is understood, Bárány, have assumed a supra-nuclear centre in the brain stem which co-ordinates conjugate eye movements. However, somewhat more recently, the great Dutch team which worked under the leadership of R. Magnus up to the date of his untimely death, have thrown doubt upon these views. They have elicited nystagmus in all directions in decerebrate preparations. De Kleyn has proved good lateral nystagmus in a preparation deficient of cerebrum, cerebellum and upper part of the brain stem. Both third and fourth nuclei were removed. The nystagmus was caused by reciprocal contraction and relaxation of the two external recti, the only eye muscles left innervated.

On general principles it perhaps seems unlikely that such a rapidly mechanical activity as nystagmus should owe anything to the cortex, the organ of discrimination, deliberation and choice.

The cerebellum, from what has just been said, is not necessary for nystagmus. Very broadly speaking, the cerebellum is not necessary for reflex movements. It seems to be an organ indispensable for properly executed voluntary movements. A mid-brain rabbit without cerebrum or cerebellum, and only enough of the thalamus retained to guarantee the functioning of heat regulation, is capable of complex postural reactions which have been exhaustively analysed by the Dutch physiologists. If such a preparation is laid on its back or side, or stood on its head, it will scramble up briskly and accurately into the normal resting rabbit posture and maintain it steadily. If pushed it will hop forward and behave very like a normal rabbit. If it is left alone and consequently no reflexes are aroused, it remains absolutely motionless, for of course it has no volition. Voluntary movements without a cerebellum are all at sea, as is well known.

The patient above mentioned occasionally showed a fleeting tendency to a cerebellar attitude. The occiput tended to turn towards the left shoulder and the chin to be twisted to the right. The trunk tended to overhang to the left as he deviated to the left. These postures are often a reflection of the strange postures assumed by a four-footed animal from which one labyrinth has been removed skilfully and recently.

The functions of the cerebellum in connexion with equilibrium can scarcely be understood without considering at the same time the vestibular reactions with which certain cerebellar functions are associated. An animal from whom one labyrinth has recently been removed assumes a characteristic posture which becomes somewhat modified in the course of time. Figure 2 shows diagrammatically some idea of this posture for a four-footed animal with the left labyrinth removed. The illustration seems to have caught the very spirit of " D " Block.

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The animal's body and neck are bent like a whiting, concave to the left. The front limbs are out of the perpendicular to the right, the hind ones to the left. The extensor tone is increased in the right limbs, the left ones lack tone. The spine is also twisted by rotation of the vertebræ so as to make the sternum overhang to the left, and the left side of the thorax face somewhat upwards and the right side downwards. Finally, the head is twisted on the neck so that the left cheek nears the floor and the right one looks towards the ceiling. There will be temporary nystagmus and a less temporary conjugate deviation of the eyes. Some reflection of this posture

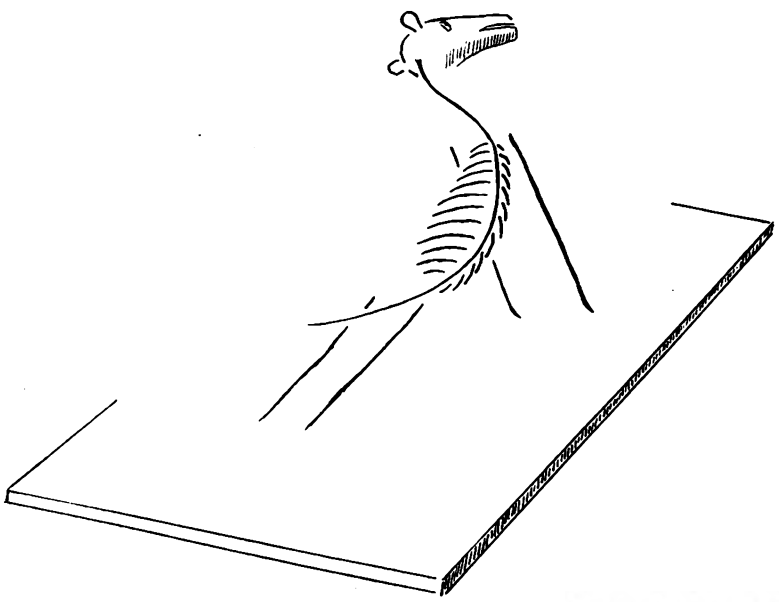


FIG. 2.—Diagrammatic representation of the posture assumed by an animal from which the left labyrinth has been recently removed. The specimen is imagined to be mounted on a board which is tilted to give a better view. In actual life the posture would be further complicated by the fact that the twisting of the thorax to the left would carry the left shoulder up and the left front foot off the ground. The animal would therefore collapse to the left in front. The atonic left forelimb would give way and let the thorax down on to the left elbow.

is frequently seen clinically in cerebellar disturbance. It has been analysed in the Utrecht Laboratory by the injection of a cocaine solution into the middle ear of normal animals. If the left ear be thus injected, the following is the result :—

(1) After about five minutes the saccule becomes paralysed, whence :—
   (*a*) The characteristic eye deviation.
   (*b*) A loss of the power of automatically correcting the position of the head into its normal position with horizontal mouth cleft, and head right way up, from a lateral or asymmetrical position of the animal's body.

At this stage there is no abnormal posture and no nystagmus.

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(2) Seven to fourteen minutes later the utricle becomes affected.

(*a*) Now begins that twist of the spine which carries the left side of the thorax over and the right side under, and displaces the sternum to the left. The spine is still in a straight line. The "whiting" bend has not begun.

(*b*) The head is twisted on the neck, so that the right cheek looks upward.

(*c*) The power of correcting the position of the head in space even from symmetrical positions is lost, i.e., if the animal is held with body vertical, head up or head down, then the head dangles or lolls helplessly instead of being brought into the normal position, i.e., with horizontal mouth cleft and head right way up.

(3) Seven to eighteen minutes later still the semicircular canals begin to suffer.

(*a*) The "whiting" curve concave to the left begins.

(*b*) Nystagmus sets in.

The loss of tone in the left limbs has not been completely explained and is rather a physiological mystery.

It is hardly enough to know from the surgical point of view that the lesion lies in one or other posterior fossa, but cerebellar localization remains uncertain. The head and eyes and trunk seem most affected when the lesion is in the vermis. The superior and inferior surfaces of the lateral lobe appear to influence the upper and lower limbs respectively of the same side.

Bárány worked out a more detailed localization in a case where extensive craniectomy in the posterior fossa left the cerebellum susceptible to chilling through the skin. He found that certain movements of the arm and leg, etc., could not be carried out when certain areas of the cerebellar cortex were chilled, and described various upward, downward, inward and outward pointing centres for the limbs, head, etc.

As mentioned above, in 1918 Dr. Isaac Jones, of Philadelphia, published a system of great precision for localization in the brain stem and cerebellum. The method employed depends on the reactions obtained by stimulating the vestibular apparatus by the caloric or rotatory tests, and their modification when focal brain lesions interfere with the central vestibular connections. Dr. Jones brings forward good reasons for assuming that the path of the fibres from the ampulla of the horizontal semicircular canal is different from that from the ampullæ of the two vertical canals. The latter are assumed to work as one unit. These two paths are in fact separate from the point whence they leave the vestibular nuclei to the point where they come together again in the cerebellar nuclei. They are thus separate in the brain stem, and separate still more widely when they leave it, for the horizontal canal fibres pass to the cerebellum via the inferior peduncle while the vertical canal fibres pass to the cerebellum via the middle

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peduncle. Fig. 3 gives a schematic representation of these paths, in the brain stem and cerebellar peduncles in accordance with Jones's view.

Now, in the normal subject, definite results, such as nystagmus, vertigo or "pass-pointing,"[1] etc., in various directions are caused by stimulating the semicircular canals. This can easily be done by turning the patient in a turning chair or douching the ear-drum with warm or cold water, and by appropriate arrangements any canal can be made to respond alone and separately from the other canals.

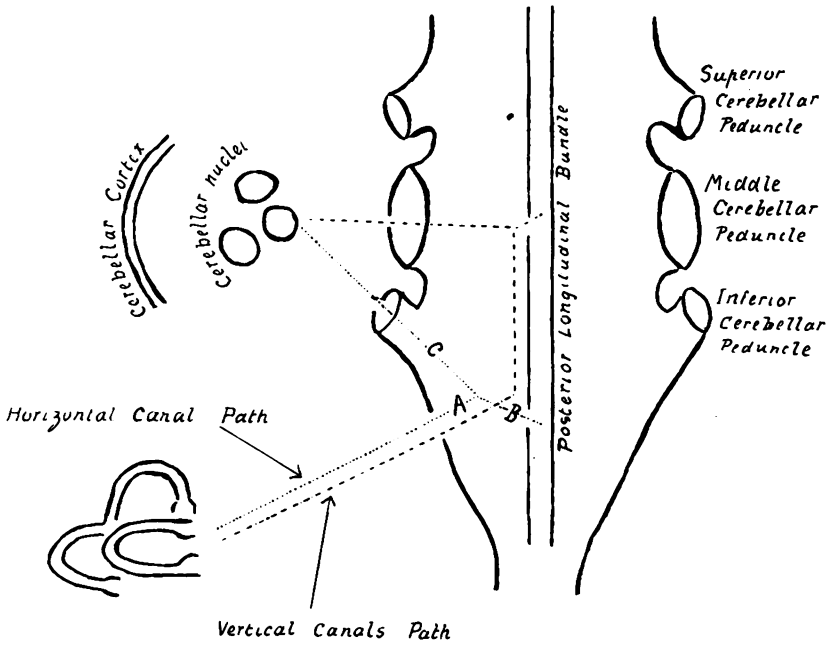


FIG. 3.

If the central path from a canal is cut, then the nystagmus, vertigo or "pass-pointing," etc., which should mark this canal's response to stimulation, will not be forthcoming. Taking the central path of the horizontal canal in fig. 3, a lesion at "A" will abolish the test responses of both

[1] This test is performed as follows: Say the right arm is to be tested for pass pointing downwards in the vertical plane. The patient is blindfolded and seated, and his right forefinger is made to touch the forefinger of the examiner held about eighteen inches from the floor. The patient is then told to raise his right arm vertically above his head and then bring it down so as to touch the examiner's forefinger again. If he "pass points" he misses it by a certain number of inches to one side or the other. A normal subject can be made to pass point in any plane by disturbing the appropriate semicircular canal. Isaac Jones maintains that this phenomenon depends purely on vertigo, and not on any anomaly of muscular tone. The vertigo may be "spontaneous," i.e., the result of disease, or may have been artificially induced.

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nystagmus and vertigo. A lesion at "B" abolishes only nystagmus. A lesion at "C" abolishes only vertigo. This one example gives some idea of Dr. Jones's methods, which have in his hands yielded remarkable and brilliant results. If the central cerebellar nuclei are destroyed, then no giddiness can be obtained by stimulating any canal (of the ear of the same side). If the cerebellar cortex is the seat of the lesion, then nystagmus and giddiness will be normal for all canals, but certain responses in pass-pointing which should be met with after stimulating the vestibular apparatus will not occur.

In this case of cerebellar tumour, both horizontal canal and vertical canals unit should have given normal responses, *qua* nystagmus and vertigo, as brain stem, peduncles and (probably) cerebellar nuclei were not greatly interfered with. There should have been some interference with the pass-pointing responses of both left arm and leg, as both upper and lower halves of the left lateral lobe of the cerebellum were subject to some degree of direct compression.

For practical purposes, apart from syphilitic cases, the only radical treatment is removal of the tumour by operation. Failing this a decompression may be undertaken to give temporary relief and save blindness. A palliative decompression is done over the site of the tumour as far as possible, if this is known. In the case of an unlocalizable supra-tentorial growth the decompression is done on the right side rather than the left. More temporary relief still is achieved by ventricular puncture. Freezing the skin is the only anæsthetic needed. A special boring instrument is made for the purpose, and patients who have submitted to this are said to clamour for a repetition of the little operation, when their headache comes on again. The conception of the radical operation would appear to have been recently extended, for in "L'Encéphale" of April, 1928, F. Lhermite comments on the results of five cases in which Walter Dandy of Baltimore removed supra-thalamically the entire right cerebral hemisphere for an "inoperable" growth situated in it. It seems worth a brief digression to summarize the results of this operation which is by no means necessarily fatal. All cases survived long enough to allow of some observation. The surgeon seems to have had rather bad luck as regards the immediate causes of death. However, one case had survived three and a half years and was very well and very grateful. There was absolutely no mental defect in any of the cases. They were all subject to profound left hemiplegia before the operation, but even after the operation some feeble voluntary movements persisted on the left side. There was no paralysis of the bi-laterally innervated muscles of expression and mastication. The thalamic elements of sensation were retained on the left side of the body. Epicritic sensation was lost.

Acknowledgments are due to Brevet-Colonel D. Ahern, D.S.O., for kind permission to write up this case.

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PROLONGED INTERMITTENT PYREXIA ASSOCIATED WITH AN UNUSUAL ORGANISM IN THE BLOOD-STREAM.

By Major F. G. A. SMYTH,
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AND
Major W. M. CAMERON, O.B.E.,
Royal Army Medical Corps.

Case 1.—On July 1, 1929, Pte. C. was admitted to the Citadel Military Hospital, Cairo, having suffered for four days from fever and vague arthralgia, with a provisional diagnosis of subacute rheumatism. He had no history of previous attacks of acute rheumatism, or of any tropical disease, but had suffered from numerous attacks of tonsillitis, and, on admission, both tonsils were enlarged and septic.

Under observation his fever was found to be intermittent, the temperature varying between 98° F. and 102° F.; the period of pyrexia rarely lasted more than twenty-four hours, and was unaffected by the exhibition of 120 grains of sodium salicylate daily. During the febrile periods it was noticed that a blotchy erythematous rash appeared on the extensor surfaces of the limbs and on the thorax. These spots, originally slightly raised and bright red, rapidly changed to a purple colour and faded in the course of a few days, leaving a brownish stain.

As the case was obviously not a straightforward one of rheumatism, a thorough investigation was carried out. Physical and radiological examinations of the lungs revealed no signs of disease. The urine was normal, and proved sterile on culture on two occasions.

The stools were cultured for pathogenic organisms and examined for cysts of *Entamœba histolytica* with negative results. Blood-films examined for malaria parasites were repeatedly negative.

On July 11 it was found that the total leucocyte count amounted to 20,400 per c.mm., but no suppurative focus could be discovered. The leucocyte count was repeated on five other occasions between this date and August 8, and was found to vary between 18,000 and 28,000 per c.mm.; differential counts showed 80 to 85 per cent of them to be polymorphonuclears.

Blood-culture was performed on July 29, during a pyrexial period, and a Gram-negative coccus grew out in pure culture in each flask of medium inoculated. The identity of this organism was not immediately apparent, but from its cultural characteristics it was soon clear that it did not resemble any known member of the *Brucella* group, nor was it a meningococcus.

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The patient's serum showed no agglutinins for *Micrococcus melitensis* (Royal Army Medical College strain), or *M. paramelitensis* (Bassett-Smith).

The organism isolated from the patient's blood resembled *M. catarrhalis* closely in its cultural properties and lack of fermentative powers for ordinary sugars. But, as at this time no previous case was known to the authors of a septicæmia associated with this organism, hesitation was felt in definitely attributing the patient's disease to the presence of the organism in his blood. In addition, emulsions of the organism isolated from the patient's blood were not agglutinated by the patient's serum. Blood-culture was therefore repeated on August 12. This proved sterile.

During these weeks, pyrexial attacks similar to those described above had recurred at frequent but irregular intervals. Nothing further, however, had been discovered during repeated physical examination. The spleen and liver were never palpable, and the patient's general condition remained remarkably good. In fact, it was most striking that between the pyrexial attacks the patient complained of nothing and even stated that he felt perfectly well. There was never any anorexia, and even when the temperature was raised the patient had no complaint except of slight headache and fleeting arthritic pains.

Subcutaneous injections of iron and arsenic were given each day for twelve days, during which the pyrexial attacks became less frequent. On August 20 the patient developed a severe attack of acute follicular tonsillitis. Smears from the tonsillar exudate showed the presence of Gram-negative cocci resembling the coccus isolated from the blood. He recovered from this attack four days later under ordinary medical treatment, and from that day he made an uninterrupted recovery, and was transferred convalescent to the seaside on September 9, his temperature having been normal for three weeks.

He has since been readmitted to hospital for tonsillectomy. He states that he has had no recurrence of fever or rash.

Unfortunately, during the absence of one of the authors on leave, the organism isolated from the blood of Pte. C. died out for lack of sufficiently frequent subculture. It was not apparent up to then how very delicate an organism it was.

Case 2.—On November 4, 1929, Trooper W. was admitted to the Citadel Military Hospital, Cairo, suffering from fever and arthritic pains. He gave a history of chronic otitis media dating from 1928, and had a moderate degree of catarrh of the nose and throat. His fever was of a daily remittent type, varying between 102° F. at night and 98° F. in the morning.

In view of the absence of physical signs and the presence of an erythematous rash on the arms and chest, blood-culture was performed on November 8, and a Gram-negative coccus grew out in pure culture which was immediately recognized as being identical in appearance and growth with that isolated from Pte. C. the previous July. Like the previous organism it proved in early subculture to resemble *M. catarrhalis* more closely than any other known organism.

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W. are still under investigation. Their resemblance to *M. catarrhalis* is not now so marked, as involution forms have appeared in subculture which have not been previously described as occurring in cultures of *M. catarrhalis*. The bacteriology of the organism is being studied in conjunction with Major H. J. Bensted, M.C., R.A.M.C., and, it is hoped, will form the subject of another paper.

The serum of Trooper W. did not agglutinate the organism isolated from his blood; nor was this organism agglutinated by the serum of Private C., taken in December, 1929. It should, however, be mentioned that the organism has so far failed to produce any agglutinins in a rabbit injected intravenously with repeated doses of dead and live cultures.

A complement-fixation test was done, using the serum of Trooper W. and a saline emulsion of the organism as an antigen. This proved negative.

Trooper W.'s condition remained practically unchanged through December, 1929, and the first half of January, 1930, though from December 15 his rises of temperature were less high and less frequent, and there were whole days in which the temperature remained normal. It was again remarkable that his general condition was very much better than one would have expected after so prolonged a fever. The rash had now disappeared and his only complaints were of headache and slight pains in the limbs when the temperature was high.

As he failed to respond to any treatment and was fit to travel he was transferred as an invalid to England on January 19, 1930.

A total leucocyte count taken on January 6 still showed a leucocytosis of 19,000 per c.mm.

Case 3.—The occurrence of the two cases quoted above brought to mind the case of Driver P., a patient who was admitted to the Citadel Military Hospital, Cairo, on February 29, 1929, with a mild febrile bronchitis. He developed a prolonged intermittent fever similar in type to that of Trooper W., and accompanied by a similar rash and a persistent leucocytosis. He also complained of mild pains in his joints and limbs. All the common causes of such fever, such as sepsis, malaria, enteric group infection, amœbiasis, undulant fever and tuberculosis were excluded as far as possible by clinical, pathological and radiological means. Blood-cultures were negative and his condition defied diagnosis. Again the most noticeable feature of the case was the disproportion between the severity of the disease as indicated by the temperature chart and the patient's good general condition and absence of toxic symptoms. He was invalided to England in April still suffering from intermittent fever, with a diagnosis of pyrexia of uncertain origin.

From the clinical findings in this case we consider that he suffered from the same infection as Private C. and Trooper W., although the organism was not isolated from his blood.

On reference to the literature of *M. catarrhalis*, it transpires that a case

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was described in 1928 in Germany, by Nagell [1], of a young man who had attacks of fever every two days. From his blood an organism was recovered on four occasions which behaved culturally like *M. catarrhalis*, but which was so delicate that it died out after two or three subcultures. The patient had a skin eruption described as resembling a typhoid roseola. Sections were made of an excised portion of affected skin, and an organism was demonstrated which resembled that isolated from the blood.

Summary.

(1) Three cases of intermittent pyrexia occurred among British Troops in Cairo in 1929, which, after exhaustive investigations, could not be attributed to any of the common causes. They showed the following clinical features in common :—

(i) A preliminary history of catarrhal inflammation involving the nose and throat.

(ii) A prolonged irregular intermittent pyrexia the temperature varying between 98° F. and 104° F., not accompanied by rigors or sweats.

(iii) The presence, in the early stages of the disease, of an erythematous rash most marked on the extensor surfaces of the arms and legs and on the thorax.

(iv) A complete absence of other physical signs. There was no enlargement of the spleen.

(v) A high total leucocyte count varying between 18,000 and 35,000 per c.mm., with a relative polymorphonuclear leucocytosis of between 80 and 85 per cent.

(vi) A marked absence of toxic symptoms and of general debility after weeks of fever.

(2) In two of these cases, a Gram-negative coccus was isolated from the blood-stream which is at present unidentified and is the subject of further investigation. This is being pursued with difficulty owing to the rapidity with which the organism dies in artificial media.

(3) We are of the opinion that the condition is one of septicæmia and that the Gram-negative coccus is the causative agent.

Our thanks are due to Lieutenant-Colonel T. S. Coates, O.B.E., R.A.M.C., Officer Commanding, Citadel Military Hospital, Cairo, for permission to publish these cases.

REFERENCE.

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Editorial.

THE ANTI-INFECTIVE ACTION OF CAROTENE.

During the past few years the relation of carotene to vitamin A has been much discussed.

Carotene is one of a group of coloured substances known as lipochromes. It is widely distributed in nature and is found in carrots, cabbages spinach, tomatoes, maize, eggs, milk, and palm oil. It is an unsaturated hydrocarbon having the empirical formula $C_{40}H_{56}$. It crystallizes in leaflets and is very soluble in carbon bisulphide, but only slightly so in alcohol, petroleum ether or chloroform.

Some workers have found that the yellow pigment, even when crude, is not an active source of vitamin A, while others state that it is an extremely active source and that its activity actually increases with purification.

The relationship between carotene and vitamin A was put on a more definite footing in 1928 when Euler, Euler and Hellström showed that samples of crystalline carotene, presumably pure, possess growth-promoting powers similar to those of vitamin A.

Many other carotenoid pigments were tested but only one *a*-dihydrocrocetin was found to be active.

In 1929 the position again became rather obscure, as Dulière, Morton and Drummond, using a very pure example of carotene, found it to be inactive. Green and Mellanby think this discrepancy may be explained by the fact that Drummond and his co-workers used a fat-free basal diet. It may be that carotene is only absorbed in the presence of fat.

Hume and Smedley, however, maintain that the presence of fat in the basal diet is not a factor of any importance in the determination of the biological activity of carotene; but the solvent employed has a marked influence. Drummond used ethyl oleate as the solvent, and Hume and Smedley found that rats given carotene dissolved in ethyl oleate began rapidly to decline, whereas when given carotene dissolved in hardened cotton-seed oil they grew well. The carotene in ethyl oleate was rapidly decolorized. Hume and Smedley consider that the unsuitability of ethyl oleate as a solvent for carotene affords a sufficient explanation of the discrepancy between Drummond's results and those of other workers on the activity of carotene as a source of vitamin A.

Moore's work, published in 1929, confirmed the statements of Euler, Euler and Hellström that carotene possesses intense vitamin A activity. The carotene used in his first experiments was obtained exclusively from carrots. In his later work he found that carotene obtained from the unsaponified matter in red palm oil was also active as a source of vitamin A in

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doses of 0·01 milligramme daily; 0·2 milligramme of the unsaponifiable matter, however, gave only irregular growth and was nothing like so active as the purified carotene.

It is of course quite possible that the active principle is an impurity adhering to the carotene, but against this view is the fact that Collinson and Moore did not find that increasingly pure samples of carotene had less vitamin A activity.

It seems to be clear that if carotene has the properties usually associated with vitamin A, and even if it is the actual substance responsible for the vitamin A activities of green vegetables, butter and egg-yolk, it is not the same substance as vitamin A in liver fats. The carotene content of these fats is very small, yet they contain substances which have as much vitamin A activity as crystalline carotene. Liver oils containing vitamin A give with antimony trichloride a transient blue colour and have an absorption band at 610 to 630 $\mu\mu$, while carotene gives a deep blue colour with the same reagent and has an absorption band at 590 $\mu\mu$.

Vitamin A in liver oils can be extracted from the unsaponified fraction by alcohol, while carotene is only slightly soluble in alcohol. The association of vitamin A with other lipoid material when prepared from liver oils may modify some of its attributes, but the weight of evidence seems to be in favour of its being a different substance from carotene.

In 1928 Green and Mellanby showed that rats fed on a diet devoid of vitamin A ultimately developed multiple infective lesions and died. They also pointed out that the septic foci of inflammation which occur in the rat are also found in man.

Now, most of the experimental work on carotene and its relation to vitamin A has depended on observations concerning its effect on the weight of rats which had begun to lose weight as the result of vitamin A deprival. Green and Mellanby considered that a better test would be the resistance of rats to infection as, if carotene has the biological properties of vitamin A, it ought to be equally effective in preventing the occurrence of generalized infection. Their preliminary experiments quickly showed that it was probably as efficient as vitamin A in this respect, and further work was only required to determine the minimal doses which had preventive and curative effects. In this further investigation a diet was used containing fat and vitamin D, and which also had a good calcium-phosphorus ratio. The diet was devoid of vitamin A. A sample of crystalline carotene, having a melting point of 174° in air, was used and the required amount dissolved in ether was placed on a little casein. When the ether had evaporated the casein was intimately mixed with the food.

The results showed that carotene was a very powerful anti-infective agent. In rats complete protection against infection was always obtained when more than 0·04 milligramme of carotene was given, even though the animals had been deprived of vitamin A for a considerable time before the experiment was commenced. On the basis of previous results Green and

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Mellanby think many of these animals must have developed an infection during the depletion period, but complete recovery and good health followed. In the case of animals receiving only 0·02 milligramme of carotene the protection was good and growth followed, but when only 0·01 milligramme was given many of the animals died with organs invaded by micro-organisms. With 0·005 milligramme of carotene the protection was still less, though when compared with controls the animals seemed to have an increased power of resistance.

The authors say it is difficult to state the exact protective dose in the rat, but they think that if the animal's body has not been completely deprived of vitamin A a daily dose of 0·02 milligramme will probably be sufficient. When cabbage was used as the source of carotene, 0·5 gramme of the dried leaf, equivalent to five grammes of cabbage, always afforded complete protection.

The relation of carotene to growth is of importance, as up to the present the crucial test of vitamin A has been its power to influence growth rather than its power to confer resistance to infection. Green and Mellanby continued their observations with carotene for much longer periods than had been the case in other recorded experiments. They watched the effect of carotene on growth for more than eighty days instead of the usual twenty-eight to thirty-five days. They found that where no signs of infection occurred the animals continued to grow to the end of the experiments. Occasionally growth continued though slight signs of infection were found post mortem. They consider that if the power to promote growth for a period of four weeks after complete depletion of vitamin A be accepted as the test, then the statement of Euler and Moore that 0·005 milligramme of carotene is efficient may be considered as correct. But the protective power of this amount is slight and animals so treated will probably die later from septic infection. In other words the amount of carotene required for protection is greater than that required to stimulate growth for a short period, the comparative amounts for the two purposes being 0·02 milligramme to prevent infection, and 0·005 milligramme to promote growth. In these growth experiments it was noticed that even without vitamin D growth continued for seventy-eight days in animals receiving 0·01 milligramme of carotene.

Green and Mellanby are not able to give any explanation of the mode of action of carotene or vitamin A in raising the resistance of the body to infection. In earlier papers the question was discussed whether the first phenomenon produced by lack of vitamin A was hyperplasia of the cells or infection of the epithelium. When 0·01 milligramme of carotene was given and the animals developed local septic foci there was no hyperplasia apparent to the naked eye in organs other than those infected. They consider that the investigation of this question is simplified now that we have in carotene a substance functioning as vitamin A which can be given in accurate doses and free from complicating factors.

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Euler, Euler and Karrer have found carotene in the liver of rats fed on this substance when the dosage was above 0·29 milligramme. Green and Mellanby suggest from their observations of the livers of carotene-fed rats that it is stored not as carotene, but as vitamin A. That carotene might be a provitamin A was first suggested by Moore.

Though Green and Mellanby assigned anti-infective function to vitamin A, they realized that there might be other factors associated with it in the green portion of the plant or in the liver oil, which might play a subsidiary part in the protective action. The fact that carotene alone in sufficient doses protects an animal against infection, indicates that the effect in both cases is due to one chemical entity. Since vitamin D protects against rickets in doses so small as 0·001 milligramme, a much smaller dose than is necessary for carotene to act as anti-infective agent, they hesitate to ascribe the specific protective power to carotene itself, as there is a slight possibility that the active agent may be an impurity, a carotenoid derivative allied to the vitamin A compound as found in liver. They consider, however, that the balance of evidence is in favour of the view that carotene is itself the specific substance, and that it is responsible for the vitamin A properties of green vegetables, carrots, and butter and probably egg-yolk.

In 1928, Euler stated that the ether-soluble lipochrome extracted from human blood not only gave the characteristic blue colour with $SbCl_3$, but also the absorption band of carotene. If this be so, there seems a possibility that the liver stores its vitamin A as a highly active leuco form of carotenoid, which may be reconverted to carotene and liberated in the circulation as required.

Green and Mellanby conclude their research by stating that if carotene has a similar function in man to that in the rat, as seems probable, it should prove valuable both as a prophylactic and a curative agent. As a therapeutic agent it should be of special importance for rapid action, as it can be given without the large amount of lipoid material which has to be given in massive vitamin A therapy with liver-fat preparations.

Carrots have been shown by Moore to contain a large amount of carotene and greater use should be made of them when there is evidence of vitamin A deficiency.

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Clinical and other Notes.

WASTE ENGINE OIL AS A FUEL FOR INCINERATION AND HEATING WATER.

By Major R. DAVIDSON,
Royal Army Medical Corps.

(A) Waste Engine Oil as a Fuel for Incineration Purposes.

Method No. 1.

(1) *Apparatus*: *See Diagram* 1.—This consists of: (*a*) water and oil reservoirs fixed on a stand on both sides of the incinerator; (*b*) feed pipe to lamps; (*c*) lamps of wire gauze filled with asbestos packing and connected directly to feed pipe (*d*) shield to prevent liquids putting flame out; (*e*) circular ventilator connected to shield above lamp with one end passing into the incinerator flue; (*f*) flash pan situated immediately below lamps which collects excess water and oil from the lamps and is ignited at irregular intervals by flaming oil dropping from the lamp above; and (*g*) a rectangular grid fixed above the fire bars of the incinerator and on the top of the apparatus to prevent choking of the flame when fresh material is put in.

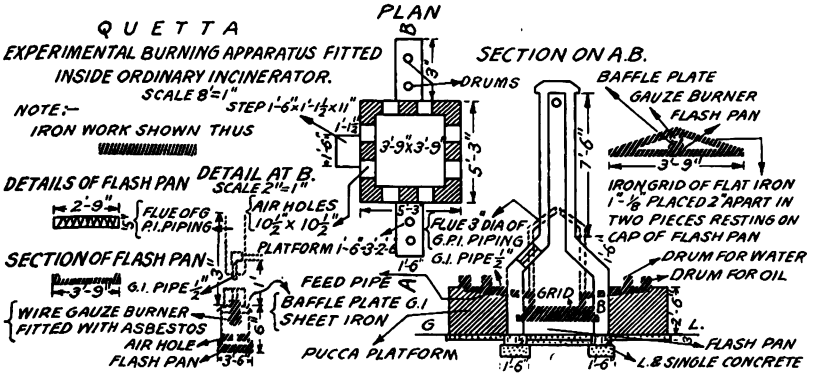


Diagram 1.

(2) *Method of Igniting.*—Waste oil from the oil reservoirs is first turned on until the lamps are saturated. They are then lit by placing a previously lit piece of cotton waste soaked in the oil underneath the lamps, withdrawing it as soon as the lamps are going properly. As soon as this occurs, the water is turned on in the proportion of 3 drops of oil to 2 of water. Any variation from this proportion will eventually put the lamps out. An immense flash can be obtained by giving an extra ten drops of

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water every ten minutes, but this requires very careful supervision and should only be carried out by a specially trained man.

(3) *General Review of Apparatus and Working.*—(*a*) Oil consumption worked out at one drop of oil every three seconds.

(*b*) The contents of the incinerator which was half full were completely reduced to a fine ash in two and a half hours.

(*c*) The regulation of the feed depends on: (1) The density of the oil and; (2) variations in the daily temperature which make the oil thicker or thinner.

(*d*) Waste oil from the sumps of motor vehicles was used, but when this was not available crude oil (strained) was found satisfactory.

(*e*) The cost of this apparatus was 30 rupees.

(*f*) The type of incinerator to which this apparatus was attached was the ordinary large closed beehive pattern.

Method No. 2.

(1) *Apparatus: See Diagram* 2.—This consists of: (*a*) water and oil reservoirs fixed on a stand on one side of the incinerator; and (*b*) feed pipe to a one inch flash pan provided with dimples and resting on the flat grate of the incinerator. Over this is placed a six-inch grate cambered in the centre so as to prevent the fire being put out by the addition of fresh material.

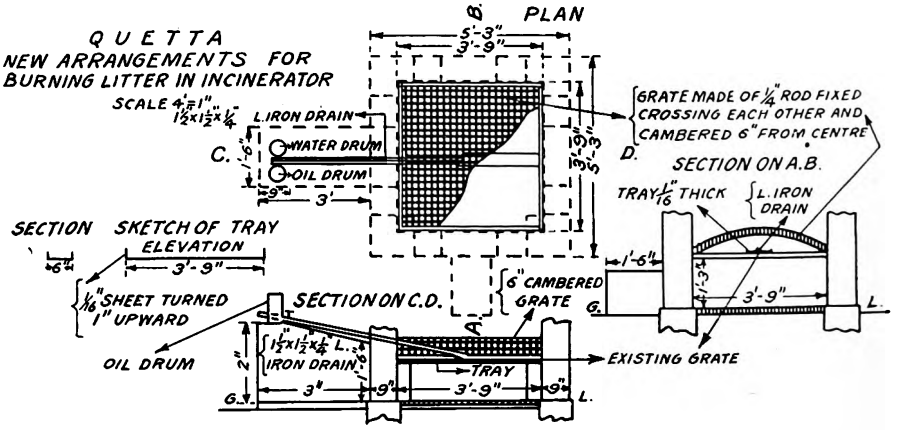


Diagram 2.

(2) *Method of Igniting.*—A piece of rag is smeared with oil, placed on the flash pan and lighted. As soon as it is well alight the container taps are turned on so that there is considerably more oil than water. Once the fire has begun to get hot, the water can be increased until the optimum flow of each is found by experiment.

(3) *General Review of Apparatus and Working.*—(*a*) The type of oil and incinerator was the same as used in Method No. 1.

(*b*) Oil consumption worked out at two pounds daily when the

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incinerator was dealing with fæces of fifty men, most of this being liquid dysenteric stools.

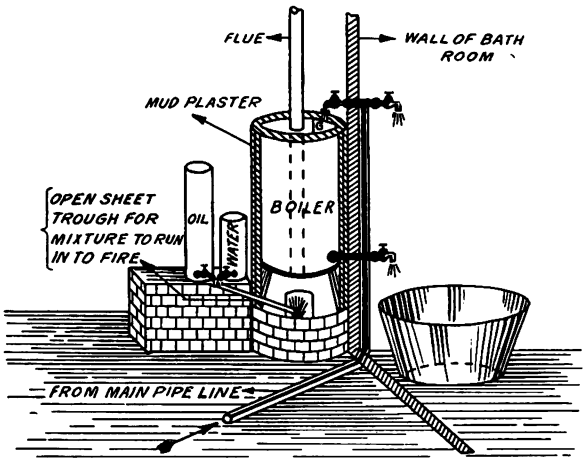


Diagram 3.

(*c*) The ash obtained by this method was finer than in Method No. 1.

(*d*) The Indian sweeper could easily be trained to work this method with little supervision.

(*e*) The cost of this apparatus was 50 rupees.

General Remarks on Both Methods.

(1) Method No. 2 is the simplest and most efficient.

(2) A shield is necessary in any type to prevent the flame being put out by liquids.

(3) The feed from the oil reservoir must be regulated according to: (*a*) different densities of waste oil, and (*b*) variations in daily temperature which would make the oil thicker or thinner.

(4) Crude oil (strained) will act as an efficient substitute for waste oil when necessary.

I am indebted to Major W. R. Norton, R.E., for much help in carrying out these experiments.

(B) Waste Oil as a Means of Heating Water in Persian Heater.

A modification of Method No. 2 can be used for this purpose, vide Diagram No. 3.

As a rule two drops of oil to one of water gives the best results. I am indebted to Colonel A. Spitteler, I.M.S., for a description of this method.

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POST-EPILEPTIC AUTOMATISM AS A DEFENCE IN A CASE OF MURDER.

By Lieutenant-Colonel OWEN A. R. BERKELEY-HILL, D.M.Oxon., I.M.S.,
Medical Superintendent, Ranchi European Mental Hospital.

In order to introduce, in response to popular desire, an extra-legal amendment to the law of homicide, insanity becomes increasingly common as a legal fiction to square a rule of law which calls for conviction. In the *Journal of Mental Science* for 1929 there appears an account of a case very similar to that which came to my notice in the latter part of the same year. In that case as well as in mine, the man charged with murder had been a soldier in the British Army. In the first case the presence of *petit mal* had been diagnosed at a Medical Board and the man was discharged as unfit for service. In my case the attacks of *petit mal* had passed unobserved by all but the patient himself who considered them too trivial for report.

The personal history of my patient is briefly as follows. He is the child of unknown parents and is now 22 years of age. He was born in Edinburgh and was educated by the Edinburgh Parish Council. At the age of 12 or 14 (he is not quite sure which), he was sent to a training ship and eventually passed into the Merchant Service where he remained for two years. He then gave up the sea and took up work in an enamel factory. He did not stick to this long and became a tramp. He then took to various jobs but never learnt a trade. In 1925 he enlisted in the Army and joined the Royal Artillery. In the following year, either at Woolwich or Edinburgh (he cannot recollect which), he was in a public bar and had what he believes was his first "fit." He remembers nothing beyond the fact that he awoke to find himself in the guard room. We may presume that he was arrested for appearing to be under the influence of liquor. He was subsequently admonished as this was his first offence. In 1927 he came out to India and suffered on and off from "fits" which he describes as a "blurring of the eyes" preceded by a headache. He says he feels giddy at the time so that he may catch hold of something to support himself. The whole affair only lasts a few seconds.

In December, 1928, he underwent an unsuccessful operation for renal calculus. The operation was performed again in January, 1929, but with no better result. It appears from the skiagram that the stone is impacted in the junction of the left ureter with the bladder. After coming out of hospital the patient says that he became "very forgetful" and thinks that he was "mentally deficient." He says the men in his battery called him "mad" but beyond this no notice was paid to his condition, although the patient says that at that time he "could do nothing right."

On September 13, 1929, the patient was on duty as sentry at the guard room of his battery which was then stationed at Cawnpore. It appears

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that he left his post and went into the bazaar where he fired into a crowd of persons who were performing a religious ceremony. He killed one man and wounded another. He was later found asleep in a barrack room by the N.C.O. of the guard. As the patient, on being roused, threatened the N.C.O. with his rifle, the N.C.O. went away to report the matter. A little later the patient was found asleep under a tree in the barrack square. He was carried struggling to the guard room where he again fell asleep. When he was awakened he was incoherent and resistive. Although at the subsequent trial a witness testified that the patient's breath smelt faintly of alcohol, the witness was of the opinion that the accused was not drunk at that time. In his charge to the jury, the Sessions Judge explained to the jury that they were called upon to decide whether the accused had committed murder under the influence of alcohol or while in a state of epileptic automatism. The specialist in mental diseases for the Eastern Command who was called to give evidence, was emphatic that the accused was suffering from minor epilepsy, although he admitted his examination of the accused had only lasted one hour. He based his diagnosis on the accused's antecedents having been vagrants and on the accused's own statement in respect to the "fits." While there is not much doubt that the diagnosis in this particular instance is correct, it is not improbable that in Europe a court would have challenged the validity of an opinion framed after so cursory an examination. That the transience of the stupor is no doubt in favour of epilepsy, it is by no means pathognomonic. Muskens, a notable authority on epilepsy at the present day, cites a case of an epileptic who fell into a dreamy condition at Havre and awoke in Bombay. Spratling records a similar case which lasted twenty-six days, while Alzheimer had one which lasted still longer. To establish a diagnosis between hysteria, alcoholism and epilepsy, in which conditions complete loss of memory may occur, the patient needs to be kept under close observation for a considerable period. As Muskens has pointed out, great attention must be paid to inter-paroxysmal conditions—such symptoms as headaches, their distribution and character, the presence or absence of myoclonic shocks, the presence or absence of analgesia, its distribution if present, vasomotor disturbances, reflex exaggerations, condition of the pupillary reflexes, and the changes in the psychical condition. In this matter of diagnosis, Muskens cites Falret, who pays much attention to what he terms the "glittering glance of the eyes," the headaches and the regular recurrence of the same association heralding in a psychical fit, called by him "manie avec fureur." Muskens calls attention to the fact that whether an epileptic has performed a criminal act or not, there is often in epileptics a similarity of experience. In one case an epileptic will murder a person, yielding as it were to some impulse which drives him on to perform the act apart from his conscious volition. Another epileptic will be impelled to throw an article such as a glass; again the impulse is without conscious volition. In both cases all that the patient

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will feel is relief. All recollection of the act associated with the sensation of relief may be lost. Ernest Jones and others of the psycho-analytical school, have laid great emphasis on the importance of the permanent psychical condition of any epileptic.

In such circumstances, it was a matter of considerable interest from a theoretical as well as from a practical standpoint, to carry out a very thorough examination of this case as soon as he became a patient in this hospital. His anthropometrical make-up showed no abnormality beyond an arched palate and a condition of "hammer-toe" on two toes of his right foot and on one toe of his left foot. In respect to the central nervous system, one of the most striking features was the presence of anosmia. The patient could not distinguish between the smells of sandal wood oil, oil of peppermint, oil of eucalyptus, tincture of asafœtida, tincture of valerian and camphor. After a good deal of sniffing he could detect a difference between the smell of chloroform and that of ether. The examination of the other cranial nerves showed no abnormality beyond a thin ring of pigment on the outer side of the left optic disc and the existence of a certain degree of myopia. R.E. $\frac{6}{18}$, with + 1·75 D. sph. = $\frac{6}{10}$. L.E.: $\frac{6}{18}$, with + 0·5 D. sph. = $\frac{6}{9}$. There was a fine tremor in both hands. There was no vasomotor disturbance, no analgesia, and no myoclonic shocks. For these latter symptoms the patient was tested twice daily for four days and then once daily for six days. On the sixteenth day of his detention in hospital, the patient had a slight frontal headache about noon. He took no particular notice of it and went out for a motor drive. He returned about 2 p.m. and sat on his bed. While thus engaged he felt "giddy" and got a "blurring" in his eyes. These sensations lasted about ten seconds when they passed off and gave place to what the patient described as a "nervy feeling" down the whole of the right side of his body. There was no twitching of the muscles and the headache was unaffected by the fit. Beyond an occasional fit of mild depression, no change was recorded in the psychical condition of the patient who maintained a general cheerfulness and good temper. He took part in outdoor games and danced enthusiastically.

Comments.

Although the data for the diagnosis of *petit mal* are meagre, I do not think that there is much doubt that the case is one of minor epilepsy. In respect to the medico-legal aspects of the case, I am in complete accord with the views expressed by Drs. A. R. Grant and S. M. Allan in vol. lxxv of the *Journal of Mental Science*, in their note on the case of Rex *v.* Bagguley. These writers challenge the justice of the law in making a distinction between criminal acts committed during epileptic automatism and similar acts committed in an attack of epileptic mania. Both consider it very unlikely that a jury would acquit in the latter case on account of the difficulty in bringing epileptic mania within the strict McNaghton ruling.

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In conclusion, I would like to observe that this case is the third of the kind that has come under my notice in the last ten years. The two previous cases were likewise British soldiers serving in India who shot a man dead while in a state of either epileptic automatism or hysterical fugue. In these cases, as well as in this last, there was a history of peculiar behaviour prior to the committal of the crime; but, it would appear, in no instance did the military or medical authorities pay any particular attention to this feature. I feel certain that had adequate notice been taken of the change in demeanour of these three soldiers, the murders which they each committed might have been prevented.

I would like to record my thanks to my assistant, Dr. P. P. Narayanen, for the trouble he has taken in making very careful notes on this interesting study.

Echoes of the Past.

THE REMINISCENCES OF AN ARMY SURGEON.

By Lieutenant-Colonel W. A. MORRIS,

Royal Army Medical Corps (retired).

Forty-five years ago three medical students, having completed their studies, sat in their "digs" for nearly the last time, discussing the future. They were Jack Holroyd, of the London Hospital, and Dick Sparrow and I from King's College Hospital. We were a keen trio, not in the least distinguished, but well up to the average. Our council of action eventually materialized in Holroyd's settling down as a general practitioner in Yorkshire, Dick entering the Royal Navy, and my choosing the Army Medical Service.

Having elected for the Army, I had only sixteen days to work before the examination, and as the approval of my proposal to a charming lady of North Wales depended on my success, I "set to" in real earnest.

The first person of importance that a candidate for a commission meets on joining the Army is the tailor. He is certain to track you down, and I was caught on my way to make my first bow to the Director-General of the Army Medical Service. The tailor offers to lend you money, build your clothes, and provide you with accoutrements, and be your friend for ever. It is best to start clear, but I am bound to admit that taking all in all my tailor treated me well, though he was expensive, for the thirty years he supplied me.

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Having passed the tailor and the door, the next step is into a room where three medical officers wait to test your physical fitness for the Army. This is most valuable for the candidate personally, and for the State, for no man, even if he is well up to the standard of measurements and health, is secure from a breakdown in his career, for service at times causes a great strain. The examination is just and fair, and my long experience assures me that if there is any uncertainty as to the results, rejection should follow. Slackness at this time might mean a life later.

The introduction to the Director-General is a rather terrifying ordeal, for when you are ushered into the presence of this grand old soldier you naturally feel nervous. Standing before him as he welcomes you with a "Good morning, Sir," it is impossible to fail to notice his dignity, studied courtesy and unbending politeness. Then follows a series of questions.

During this time he has passed his eye over you, and satisfied himself that you are personally and socially up to the standard, when the interview ends with "Good morning, Sir."

The Army manner must not be misunderstood, for behind it, more often than not, lie the kindest and most generous natures. Sir William Muir, K.C.B., was Director-General when I joined, and I well remember his shrewd and clever face, his waxed moustache and serious expression, but I do not remember a single incident of the interview.

The examination was held at Burlington House in rooms already familiar to me. There were 215 candidates for twenty-five commissions, but I was struck by the predominance of Irishmen. All sorts and sizes of them appeared, but as a Welshman I felt equal to any of them. The first paper on anatomy was fairly stiff, and I knew the Irish contingent would score on that subject, so I took especial pains to be neat and cover up my weakness, and scored over 70 per cent marks. In the later papers it was easy to descry the dismay of some of the candidates. I was treated fairly and well, and had just tact and sense enough not to know too much, and that helped me.

After the examination I paid a visit to my future sister-in-law's place in Yorkshire, and I remember all her kindness, and that of her husband. It was here that I received a telegram, not from the War Office, but from my tailor telling me that I had been successful, and was an officer at last. I was delighted with this message, all my student habiliments fell from me, and I felt I was starting a new life, in new clothes, with long vistas of battles, sieges, marches, and campaigns before me. This was the mirage of life, and never fully realized, but it was pleasant till I discovered its unreality.

We reached Netley on Saturday evening and were shown to our quarters by soldier servants, who unpacked our kit and dressed us. It was a new experience, especially for some from the wilds of Great Britain and Ireland; but naturally we all desired to make a good first impression in

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this new environment. After we had struggled into our uniforms, and boots, our valets put a finishing touch to our appearance with a dexterous brushing. Crossing to the Mess House we entered a brilliantly lighted ante-room where some senior officers of the Staff welcomed us pleasantly, and seemed most anxious to afford us all the help they could. I recall some of them: Surgeons Major Beatty, Tobin (Assistant Professor of Surgery), Dobson, an expert on bats and a Fellow of the Royal Society, Jopson, a keen fisherman, who later spent some pleasant days fishing with us at Llangynydyr. There was also Surgeon Vacy Ash.

Dinner was a parade (technically) and very well served. One candidate,

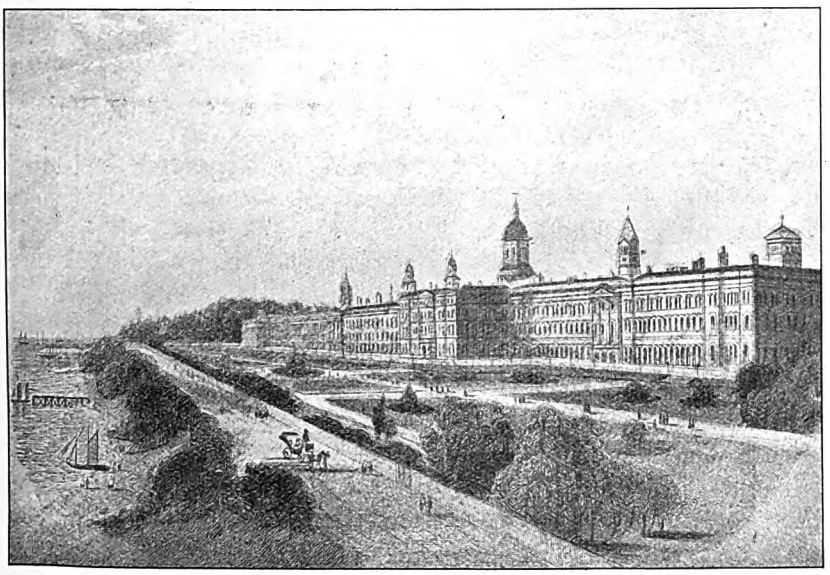


FIG. 1.—Royal Victoria Hospital, Netley.

rather overcome by the service of jelly with his mutton, remarked, "Begorra, they give you jam wid ye mate." This is rather a hoary chestnut, but bears repetition. We drank H.M. The Queen's good health loyally, and I hope most of us feel the same patriotism in these days. Dinner parade over we reassembled in the more congenial atmosphere of the billiard room, for there are few medicos who cannot play a fair hand at pool.

On the Monday morning we had our first experience of discipline, administered by Brigade-Surgeon Veale, A.M.D. Our names were called at his office. We started by crowding all over his table, but it was momentary. With a dignified wave of the hand he gave the order, "Stand in line, gentlemen, please."

"Serjeant Major, get these gentlemen into line." The N.C.O. called

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us to attention and, after explaining this evolution, remarked. "In the presence of an horfficer you must remain in the attitood of attention." "Always?" inquired a bold spirit, whose remark passed unnoticed. The Serjeant Major poked above and below our belts with his stick till he got us into a terribly constrained position. The Brigade Surgeon then admonished us as regards our general conduct, but all reference to our professional virtues was now carefully omitted. He minutely inspected our uniform, correcting it where it was wrong. Saluting was explained as far as was necessary, as four months later we were to be put through our drill. The duty of Orderly Medical Officer was explained to us and we were very carefully warned never to omit returning a salute. Further, on entering a ward, when the patients sprang to attention, we were enjoined not to keep them standing, but were to say, "Sit down, please." It was then explained that men in bed show their respect by pointing their noses to the ceiling, and laying their hands straight outside the coverlet, and by their sides. This struck us as very funny, though no one dared to show it, but there was some restrained giggling. It was not long after this that I was O.M.O., and on being led to the dining hall noticed one man did not stand up. I went to him and asked if he had heard the Serjeant call out "Attention." He good-humouredly said, "I did, but I ain't got no legs." This was true enough, for he had lost both recently on Majuba Hill.

The life at Netley was very pleasant, and the lectures we received in those days were of a very high order.

Professor Longmore led the van. His lectures were most carefully thought out and accurately delivered. I can see the old veteran standing at his desk, with one hand nervously placed in his pocket and his head thrown a little on one side. He was a handsome man with a beautifully chiselled face, showing force of character, personality, with kindliness pervading every thought and action. I was brought into close contact with him some years later, when he entrusted me with the new edition of one of his works, and I have in my possession some of his letters which show how far ahead of his time he was. I may mention one incident that occurred at the close of his long and active career. He had been the first and only professor of military surgery from the days when the Army Medical School was instituted at Fort Pitt, and was translated with it to Netley Hospital. The only reward he held at this time was the C.B., and at the end of his long service, when he was well on in the seventies, My Lords felt that he should be selected for further honour and recommended Her Majesty to knight him. He did not care for these honours, for they were the small incidents of life to him, but he did value and prize his unique and splendid service to his Queen and loved the uniform he wore.

Professor Maclean presided over the Chair of Military Medicine. He had served in India in the I.M.S. on the Madras side, and had made a most earnest study of tropical disease. A tall, big Scotchman of the finest nature, he was a great favourite with all who passed through his hands. His

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lectures were capable and practical expositions of his subject, and he illustrated his text with interesting stories and incidents. He possessed a good vocabulary, and at times became eloquent and impassioned in his delivery. There was the celebrated lecture on "Yellow Jack," a malady rather prevalent in the West Indies. He would preface his remarks by observing that he had not been there, but was speaking from notes supplied by a friend. He would patiently and quietly approach his subject, symptom by symptom, in easy flowing language, and working on and up to the prominent signs would draw a picture of a ward in a West Indian hospital and emphasize the terrors of this dreaded disease. His voice would rise and fall rhythmically, a choking sensation would invade his sentences, tears would well up in his eyes, and then in a most dramatic manner he would suddenly conclude and leave the lecture room. There was nothing insincere or artificial in a word he uttered; it was only his intense sympathy with suffering that overcame him.

Professor Maclean was a worthy compeer with Sir Thomas Longmore. He loved Netley and its students, and was never happier than when he was with them. He died at a great age, one of the most distinguished and greatest of Indian medical officers of the century.

Professor Aitken was in charge of the Chair of Pathology, and Director of the Museum. He was a civilian, who had been employed as a pathologist in the Russian War. A Scotchman with a marked native accent, Professor Aitken was rather a silent man, gifted with a quiet and incisive humour, so that he always got his Oliver for our Roland. But what we specially admired in him was his loyalty and kindness to us. This modest and undemonstrative gentleman was a powerful pillar in the edifice of Army medical education. He wrote an immense book on medicine, and from that and his beloved pickles in the Museum he lectured. These were dull compared with Maclean's or Longmore's, but we were obliged to admit that the information he gave and its accuracy helped very much. Professor Aitken was very particular over the conduct of post-mortem examinations, and would watch very closely the way they were performed. This we did in turns, and I remember one of us leaving the cerebellum in the skull by accident or carelessness. Watching the operation to its close, the Professor commented after this fashion, "A most excellent amputation of the cerebrum, gentlemen." He died in harness, and in the front rank of his profession, honoured and loved by all whom he had served so well.

No account of military medical life at this period would be complete without mentioning Dr. Edmund Parkes, the great pioneer of sanitation. I never saw him, but I felt his influence, as we all did, at Netley. References to him were very common in the lectures by his colleagues, while our official bible was his classical work on hygiene. This was a work of extraordinary interest and merit, opening up for the first time that great branch of medicine, the prevention of disease. Parkes died a com-

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paratively young man at the zenith of his fame. He was a very attractive personality, and a clear and logical thinker. Professor De Chaumont succeeded Dr. Parkes in the Chair of Hygiene. This gentleman had been a regimental surgeon in the Rifle Brigade, and was the trusted assistant to Dr. Parkes. He was a sound practical officer who had turned a long experience to good account, and though not a good lecturer he was a most efficient demonstrator. Dr. Chaumont was a refined, highly educated gentleman, as well versed in the humanities as medicine, and a musician who played the violin. He died in harness before his life's work was done. The assistant professors were: Surgeon-Major Tobin, who retired after twenty years and subsequently became one of the leading surgeons of Ireland, with a professorship and a large consulting practice in Dublin; and Brigade-Surgeon Veale, who had a very creditable career and wrote a good essay on "Mediterranean and Rock Fever." He was a thorough and painstaking officer, very popular, and the most "spick and span" of the Medical Staff. He retired, and lived in Chelsea. I met him some years later and asked him why he lived in London, which to the country-born man is an abomination. He replied, "I live twice over in London." I did not care to retort, "And wear four times as fast."

Surgeon Major J. P. H. Boileau, of whom I shall have more to write later, helped Professor Aitken and conducted the practical course. Boileau was a polished Irish gentleman, whose charming and kind ways endeared him to all. He had not an enemy in the world. I forget whether there was an Assistant Professor of Hygiene, but if there was he did not figure in this picture.

The principal medical officer was Surgeon-General Manifold, whose highly distinguished record has been worthily sustained by his brave and intrepid son, the present Surgeon-General Manifold of the Indian Medical Service. The Commandant at Netley was Colonel Sir Charles Pearson, of the Buffs, an officer with a distinguished South African record.

Once a year a ball was given by the Staff and Officers, which was a splendid affair, and for which no expense was spared. Every available residence was taken up for the convenience of relations and friends. The ball of this particular year was no less brilliant than any other, and I hired a cottage for my party. They were my fiancée, my sister, and Colonel the Hon. Charles Somerset, who had held some high posts in the Army and had been an A.D.C. to Sir John Franklin. He was a regular Somerset, with all the spirit and charm so well known in this distinguished family. He was rather gouty, especially in his hands, but retained his magic youth and was the gayest of the gay during his visit. He knew Captain Carter of H.M.S. "Hector," the guard ship moored off Netley and, having been called upon by Captain Carter, was invited to lunch with him the next day. The Colonel and I reached Netley quay and found the Captain's gig waiting for us. We took our seats, when the petty officer in charge handed the Colonel the steering guides. He looked at

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them and their arrangement behind him, and then at the six or eight sailors facing him. Full of fun, he shouted, "Hi, what do you want me to do? I have never been in such a position before, but I can drive a team of horses." "It is just the same, Sir," replied the petty officer. "I can't drive 'em behind me, man." "No, Sir, but you hold the lines, Sir, and look ahead and steer for the ship." "Which line shall I pull?" "If you will keep a gentle pressure on both she will go alright, Sir." "Very well, very well," and then to me with a most comical expression on his face, he said, "I must have faith, Morris." He was struck by the smartness and appearance of the crew, and remarked, "Fine fellows, fine fellows." In the meantime we were holding a good course for the ship, the petty officer sitting by the tiller and guiding the gig. On arrival the Colonel gave me 5s. to give to the crew, and remarked, "Tell them, Morris, what fine fellows I think them, and to drink my health."

I eventually got this prize money to them through the agency of the ship's medical officer. I dared not tip a man-o'-war's crew in the open. Of course the Colonel expected me to give the money tactfully.

A day or two later the great ball took place, and the Colonel was asked to take Lady Pearson into supper.

"D—d if I will. Pearson was very hard on my son; please detail me to Mrs. Manifold."

It was a little embarrassing, but nothing would induce him to show any special attention to the Commandant, who was as charming and pleasant as one could wish. The difficulty was tactfully overcome and a most successful dance took place.

The men of my batch were a good level lot who had emerged successfully from a stiff competitive examination. Norman Reid headed the list. He served for ten years and then died. Lewis came next. He put in, I think, twenty years, and then went to some colony. Jencken and Treherne have both attained the rank of Major General, and the latter received the K.C.M.G. Treherne was quite the most able amateur on the piano I have met. Barrett was very sociable and pleasant as a young man, and was known as the Bean. I last saw him at Allahabad, when he relieved me of the acting charge of P.M.O. Allahabad and Fyzabad Brigade. I remember he expressed a hope that I had not been taxed too much, and impressed me with the official importance of his arrival. I promised to show him round the cantonment, and in pursuance of this rode over to him the following morning with a spare horse, but he was not inclined to ride. I hope he rescued Allahabad by his timely arrival. I was retired for age at this time, and my soldiering suddenly terminated.

There was Lockheed, who became an expert surgeon in the South African War but died before promotion could reach him. James was an F.R.C.S. He was a charming fellow, commanded the Depot and became a C.B. Jerome had been with me at King's, and we had known each other for many years. Jerry was good company and a favourite, but never would

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allow himself to be overworked. Pike was an All Ireland football player, a fast runner, and finally became a Major General.

Murray Irwin was stationed with me at Allahabad, and we were great friends. He was a gentle, charming fellow, kind and considerate, and very much liked. He had a distinguished career, and ended up as a K.C.M.G. and a Major General.

E. O. Wright also was a friend of mine. He was an excellent officer, a fine sportsman, and a good horseman. He was killed in the Great War.

Joe Heath, also a special friend of mine, was killed at Sagaing in Upper Burma. I visited his grave in 1885 and found the Irrawadi River threatening to submerge it, but I hope it was saved.

My luck dogged me from the beginning of my service, for though I gained about nine places on passing out of Netley, it did not count for seniority then, or it would have made a considerable difference to me in a happy though unlucky career.

The Army Medical Mess was very well managed and very popular with everyone. A good dinner in our beautiful dining-room formed an excellent prelude to an entertainment after dinner. Sometimes we entertained an illustrious guest, and at others a senior brother officer of the good old type to wish him farewell and God-speed at the end of a long service, which could have included the Sikh Wars, but nearly always the Crimean, Indian Mutiny, Zulu and Afghan Wars. The first of these at which I was present was given to Surgeon-Major Hogge. I well remember the kind and sympathetic speech of the Surgeon General, and Surgeon-Major Hogge's interesting reply, and I know we were edified and encouraged by his modest description of his work, and felt how fortunate we were to follow such an example in a Service which commanded *esprit* and good feeling among its members.

After mess we usually adjourned to the ante-room, and finished the evening with music and singing.

I am, as I write, back in spirit, and my dear old batch seem to be all around me. The leading spirit in the music was Treherne, giving us all the help he could and making himself so agreeable at the piano. He would play a stirring piece of music, and would sing well, "If doughty deeds my lady please"; then Murray Irwin would be made to chant to us, "Abdul a Bulbul Ameer." Surgeon-Major J. P. H. Boileau, Assistant Professor, always joined us, and would contribute, with his pleasing voice, "The Rhine Wine," and we would lustily join in chorus. He would be loudly applauded. I used to sing "My Jack's come home from sea to-day." This also required a chorus. Barrett sang "The French French Bean," and was called the Bean till the end of his service. Heath and E. O. Wight and Jerome, who was a violinist, would sit and listen. The remainder would be in the billard room, but I don't remember any card playing. There were others who sang occasionally, but the dominant feature throughout

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was our camaraderie. I wonder if there are many who recollect these evenings. Many have passed over.

I returned to Netley for duty ten years later, and afterwards frequently paid casual visits to the old place, but any adventures there will be noted later. For the present our course was ended, and we merely awaited our commissions.

(*To be continued.*)

Travel.

AN EARTHQUAKE ADVENTURE.

By Major A. P. DRAPER, M.C.,
Royal Army Medical Corps.

It was in the year 1927 or 1928—I fear I cannot remember which, although it is so recent, and as for the month! my memory fails me even more. Doubtless, however, if any seismologist reads this little narrative he will be able to fix the year, month, date, hour and minute without the slightest difficulty.

I was at the time in Haifa, which, as all the world knows, is a growing port in Palestine. I had to go there to investigate the death of one of our native officers who had died suddenly.

I was returning to our headquarters at Zerka, in Transjordan, by the Hejaz Railway, and while awaiting the assembly of the train at Haifa, saw the High Commissioner's coach being put on the rear of the train; at the same time Captain F-rr-d-y,[1] the A.D.C. to the Acting High Commissioner, Colonel S-m-s, came along, and we chatted for a few minutes.

He told me that the Acting High Commissioner was coming to Zerka by train to inspect our new headquarters there, and was going on to Asrak over the Druse question. I said good-bye, and made myself as comfortable as I could in the little narrow-gauge compartment, prepared for a weary eight hours' journey before arriving at my little mud hut at Zerka, which was then "Home."

Before commencing to expend my meagre supply of literature, I amused myself looking at the none too interesting scenery which lay to either side of the narrow-gauge railway. I say none too interesting, because I had done this journey so many times before.

On the right side rose the slopes of Carmel, and to the left stretched out the bay of Acre. Carmel soon flattened out and turned to the south,

[1] This officer has recently distinguished himself during the Arab rising in Safed, Northern Palestine.

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giving way to the rich plain of Esdraelon with the ever-winding river Cison, on whose banks Deborah sang her song of victory, and whose waters ran crimson with the blood of the false prophets of Baal.

The next point of interest was the halt at Afule, the largest Zionist colony in this district, if not in Palestine. The whole colony appears to gather at the railway station either to meet or pay farewell to their friends, or for the more simple pleasure of watching the train come in and go out again.

After this the train stops at Baisan, then at Jsr-me-Jama, where the old bridge spanning the Jordan can be plainly seen from the train.

The next stop is Semakh, where the train stops for a considerable time, and from where a beautiful view of the Sea of Galilee can be seen with the mighty snow-capped Hermon in the north.

On this occasion Captain F-rr-d-y came round to my compartment to say that the Acting High Commissioner would be very pleased if I would join them at lunch in his coach; this invitation I accepted with delight, and went round to the rear of the train to which the coach was attached.

During lunch the train wound up the ever-increasing heights of the Yarmuk gorge, past El Hâmme, where the smell of the hot sulphur springs penetrated the carriage, and where from a little further on the right may be seen the old Roman town of Gadara, the present Um Keis, perched on top of a high rocky hill.

The train steadily crept up and up the gorge, finally entering a cutting in the right bank, with a sheer drop on the left to the bottom of the gorge where the swirling torrent of the Yarmuk dashes down to join the Jordan shortly after it leaves the Sea of Galilee.

I cannot remember what we were talking about at the time, when suddenly a crash made us all look up, to see the side of the coach splintered all up one side: before we had time to speak, another crash occurred on the roof.

Comparing notes afterwards, we had all apparently thought that these crashes were the result either of bombs thrown from the hill, or by the train wreckers rolling rocks down the hillside on to the train. Eventually one of us had the temerity to look out of the rear window which commanded the whole of the track up which we had ascended. What was our astonishment when we observed a whole series of miniature avalanches shooting down the hillside into the railway cutting.

The situation was now clear, it was an *earthquake* which was shaking down the boulders and smaller rocks which were but lightly poised upon the hillside.

For some minutes this continued, when suddenly a grinding was followed by a sudden jerk which deposited us on the floor and brought the train to an abrupt stop.

We three immediately descended and ran along the metals to the front of the train to see to our astonishment that the engine having struck an

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enormous boulder which was lying on the track, had left the rails, and luckily for us had turned right and buried itself in the cutting, lying on its right side as if very tired : if it had turned left off the rails the whole train would, without doubt, have precipitated itself into the gorge, a sheer drop of about 200 feet, and we should, none of us, have been left to tell this tale.

As it was, not a soul, even the engine driver or fireman, was hurt.

Well, there we were, a train load of people of assorted sexes and nations stranded about half way up the Yarmuk Valley about 3 o'clock in the afternoon.

Among the passengers were two American ladies who were on their way to Damascus, and who seemed in no way perturbed by their adventure. The High Commissioner commissioned me to ask them if they would do him the honour of having tea in his coach, which was not derailed. They accepted this invitation with delight, and we all sat down to a most enjoyable meal in the circumstances.

Luckily the mishap had occurred fairly close to the station of Sadiara which possessed a telephone through which a message was sent to Deraa for relief, so we did not expect to have to wait so very long for help to reach us.

Tea finished we all strolled about the railway line, reconstructing the accident.

It so happened that amongst the other passengers was a warrant officer in my own force who was travelling from Jerusalem. He was bringing with him a new gramophone and some half dozen or so new records amongst which were some by our old friend the Whispering Baritone, Jack Smith. These were played over and over again, as they were then new to all of us, until they were nearly worn out, indeed one or two enthusiastic members of our party endeavoured to dance to them, but finally this had to be abandoned owing to the roughness of the railway metal being found not very conducive to the Terpsichorean art.

Time gradually wore on, and news came through that several other blocks had occurred on the line between us and Deraa, and that several hours must elapse before the relief train would arrive. My only worry during this time was my wife's anxiety, as she expected me home by 6 o'clock that evening. I was also very worried as to how she had fared during the earthquake, as we were at that time, as I have mentioned before, living in a very flimsy mud hut at Zerka. The High Commissioner reassured me, however, by saying that they were the safest dwellings of any sort in an earthquake, as there was so much "give" in them; this was afterwards proved by my wife telling me that the only thing she noticed was the doors rattling, and the dogs barking.

Eventually about 10.30 p.m. the relief train arrived with much snorting and groaning as if it realized its own importance at being called to the relief of so many weary and distressed human beings.

Well—after resuming our sadly interrupted journey we reached Deraa

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at about 12.30 a.m., to find luckily that the refreshment room had been kept open specially for our benefit, and there we enjoyed much needed refreshment.

Our wait at Deraa was not, however, destined to be prolonged, for in about five minutes with a puffing and a clanking the District Railway Superintendent arrived from Amman in his motor trolly which was sufficiently large to accommodate the "Sahib Log" bound for Zerka: So after bidding farewell to our American friends who had embarked on the Damascus train, we embarked in the motor trolly and puffed down the line towards Zerka, where we arrived about 2 a.m. none the worse for our adventure, except being extremely tired.

My wife, thank God, had suffered no anxiety as she had heard of the accident, and that there had been no casualties.

Note.—It will be remembered that this earthquake caused a lot of deaths in Jaffa, Ludd, Jerusalem, and Amman, and that Jericho fell down for the second time.

Current Literature.

OLLETT, E. T. **Air Filtration.** *Domestic Engineering.* 1929, v. 49, 150-54, 5 figs. [1 ref.]

This is a useful little summary of the methods of removal of dust from air. Observations by the author and others whom he quotes indicate that dust may be present in the air in quantities approximating to the following:—

Per cubic metre:	*Milligrams.*	*Particles in Millions.*
Country	2	500 to 5,000
Residential towns	2-10	5,000 to 45,000
Industrial areas	25-50	5,000 to 80,000

The above amount for a residential town is better realized from the given datum that 1¼ lb. of dust per hour is removable from the air supplied to a cinema seating some 2,000 persons.

(*a*) *Filters for removal of ordinary-sized particles* may be:—

1. *Dry cloth*—effective when air velocity is under 20 ft. per minute.

2. *Water-spray*—effective up to velocity of 500 ft. per minute, when it removes 95 per cent. of other dust but only 70 per cent. of soot.

3. *Oil-film*, on a metal mesh in 'cells' like boxes of honeycomb, removes 98 per cent. of dust, which adheres as air percolates through and is removed by taking out one cell at a time and washing it in hot soda solution, after which the cell is refilmed with oil and replaced. It does not remove fog unless air be dried to drive off water filming each dust speck.

4. *Water-spray and oil-films* may be combined so that the spray removes fog while the film removes soot.

(*b*) *Methods for removing very fine industrial dusts and smokes*:—

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1. "*Cyclone separators*" are useful only for large, heavy particles.

2. *Settling chambers* remove heavy particles over 0·1 mm. diameter if the velocity be under 10 ft. per second. Particles of less than 10 microns will not settle under any commercial conditions.

3. *Textile-bag filters* deal effectively with fine dust and some smokes. They are cleaned by automatic beating while the air current is reversed so as to flow from without the bag inwards. The cleaning air current may be warmed if the dust be damp and hence adhesive.

4. *Electrostatic* means are based upon the familiar fact that dust particles readily take an electric charge (hence explosions of coal-dust, starch, etc.). As the air passes between electrodes charged at 30,000 to 50,000 volts, the dust particles settle upon the positive electrode—which is a reinforced concrete slab set on the slope so that the dust slides off as it accumulates.

For general use, the author recommends the textile-bag filter provided it be fitted with the automatic, self-scavenging device.

P. S. Lelean.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 2.

Weston, W., & Remington, R. E. **The South Carolina Food Research Commission. Preliminary Report on its Organization and Activities.** *J. Amer. M. Ass.* 1929, v. 92, 2161-2, 1 map. [4 refs.]

This Commission was established for the purpose of making an elaborate investigation as to the occurrence of the mineral elements in the foods grown or produced in the State of South Carolina. The incidence of thyroid enlargement among the school-children of this State is lower than in any other part of the United States, with the possible exception of the coastal region of Connecticut, and it was, therefore, interesting to find that the amounts of iodine in South Carolina vegetables are enormously greater than those reported in vegetables from northern and western States. It has been found that leafy vegetables are richest in iodine, root crops come next, with the Irish potato showing more than the sweet potato or other edible roots. Cereal grains are poor in iodine, regardless of where they are grown. Certain facts obtained seemed to oppose the theory that the normal source of iodine in the soil is from sea spray, and the suggestion that the higher iodine content of South Carolina vegetables is due to the widespread use of Chilean sodium nitrate could not be verified. A complete investigation of the diet of goitre patients is being made, and in 27 patients investigated already it was found that in only four cases did vegetables enter into the daily diet. These were of unknown origin, usually from cans, and were consumed in small portions. Some preliminary analyses indicate that foods with a high iodine content are also relatively rich in iron and manganese, which suggests that these elements may be interdependent in the parts which they play in plant and animal nutrition.

H. N. H. Green.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 2.

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ALQUIER, J. Valeur biologique et hygiénique du vin. **[The Biological and Hygienic Value of Wine.]** *Bull. Soc. Sci. d'Hyg. Alimentaire.* 1929, v. 17, 115-59; 182-221. [Refs. in footnotes.]

This subject is one which the author considers might be appropriately dealt with in a rhetorical vein to an accompaniment of music, but is actually approached from the point of view of experimental evidence. Considering that wine furnishes from 7 to 10 per cent. of the total energy value of the Frenchman's diet, it is a matter of considerable importance both from the hygienic and economic point of view to assess the effect of this national beverage on the well-being of the French nation. It is emphasized at the outset that wine is not identical with diluted alcohol, and neither the good nor the ill-effects ascribed to wine can be attributed entirely to the alcohol it contains. The fact that wines are still widely prescribed in the treatment of various diseases may or may not be evidence of their beneficial effect on certain of the physiological processes concerned in promoting good health. At least it has been shown that wines tend to prevent certain types of infectious disease by reason of their bactericidal properties; mixtures of wine with contaminated water will kill off typhoid, cholera and other bacteria in the space of a few hours. The nutritive properties of wine depend on a great many factors, of which ethyl alcohol is but one. The higher alcohols that occur in wine are more toxic than ethyl alcohol, but they are not present in such high concentration in the spirit distilled from wine as in the spirit distilled from beetroot or maize. The ethers, aldehydes and volatile acids contribute to the bouquet of the particular variety of wine and thus may be of importance from the point of view of exciting gastric secretion.

Salts of tartaric acid tend to be precipitated in 10 per cent. alcohol, there is no evidence that the ingestion of tartrates from this source is harmful to man, even if his kidneys are already damaged. Tannin is found in relatively large amounts in red wine, but it disappears with ageing: the amount consumed by a wine drinker is less than that taken by a tea drinker. The nitrogenous matter of wine is probably of no great biological significance. White wine is apt to contain traces of foreign protein introduced to clear it, and sensitive people may be upset by drinking even very amounts. Organic phosphorus is a constant constituent of wine, and in the form of glycero-phosphates may represent an important therapeutic agent. Sulphur is sometimes added to sweet white wine in the form of SO_2 to stop fermentation before the sugar has completely disappeared: this practice is controlled by law, but even so, is not altogether desirable. Other valuable mineral salts are furnished by wine, including a liberal supply of potential aikali-forming elements.

The vitamin content of wine is negligible. Feeding experiments conducted with guinea-pigs are referred to, in which the addition of a small ration of wine to the daily diet apparently caused the production of bigger litters of young with a decreased mortality-rate among both parents and

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young. In the case of man the experiments of ATWATER are mentioned to prove that alcohol can be used as a source of energy for heat production. Controlled experiments have been carried out with a working farmer's family to determine the practical effect of adding to their simple food a daily ration of wine. In general, the greater the allowance of wine, the less was the consumption of other foods, but the weights of all members of the family were maintained or increased in spite of very heavy manual work, and their general health and efficiency is stated to have been rather better during the periods when they were taking wine than when they were without it. Experiments with horses are quoted, designed to assess the value of wine as a stimulating agent for the purpose of increasing the output of work. It was found that wine given to animals that were out of condition, or to young animals, lowered rather than increased the output of work immediately afterwards. On the other hand, a strong fit adult animal was enabled to increase its output of work if wine well diluted were given a short time previously. Finally, in view of the comparatively low cost of wine in France, and the absence of harmful effects when taken only in moderate amounts, the author concludes that wine should be placed in the category of beneficial foods.

S. J. COWELL.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 2.

MINKEWITSCH, I. E. Die Bakterien der Coligruppe im Vogeldarm und ihre Bedeutung für die fäkale Wasserverunreinigung. [**Intestinal Bacteria of Colon Type in Birds in Relation to Water Supply.**] *Ztschr. f. Hyg. u. Infektionskr.* 1929, v. 110, 506-12. [9 refs.]

[Military Med. Academy, & State Inst. for Exper. Med., Leningrad.]

The character of the normal intestinal flora of the various species of wild and domesticated birds is a problem of great theoretical interest, and of some practical importance in connexion with the possible contamination of water supplies. The author commences his paper with a useful summary of the findings of previous workers, recording the isolation of colon bacilli from the hen, pigeon, turkey, duck, goose, black-headed diver, sea-gull, stork, ostrich, crow, swallow, blackbird and sparrow. He then reports his personal observations on 74 specimens of intestinal contents, or of excreta, from various birds.

As examples of domesticated land birds, he examined 10 hens and 2 pigeons. *Bact. coli* was recovered from 9 hens and 1 pigeon. Enterococci were isolated from all the hens and one of the pigeons.

As examples of domesticated water-fowl, he examined 5 geese and 17 ducks. All 5 geese, and 15 of the 17 ducks yielded *Bact. coli*: all 5 geese and 12 ducks yielded enterococci.

Examples of wild birds included a raven, wrens, crossbills, woodpeckers, titmice and a tree-creeper, 14 in all. *Bact. coli* was recovered once only, from the raven, a notorious carrion-feeder. Enterococci were recovered on three occasions.

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Twenty-six wild water-fowl were examined, 9 gulls, 15 terns, one wild duck and one diver. From the gulls and duck *Bact. coli* was constantly recovered; but none of the terns gave cultures of this organism. In this connexion the author notes the difference in feeding habits between gulls and terns, and refers to an earlier paper in which he records his failure to isolate *Bact. coli* from 81 smelts caught on the high seas, though he frequently found this organism in other kinds of fish.

It would appear that the presence or absence of *Bact. coli* in the intestinal tract of birds depends largely on their feeding habits. The author, in 1927, had an opportunity of examining the water of a mountain lake, in which wild duck and snipe were found from spring onwards: *Bact. coli* was never present in 100 c.c. of the lake water. An observation is, however, cited from Los Angeles in 1916, which suggests that the local water supply was contaminated by ducks.

Forty-six of the strains of *Bact. coli* were submitted to the tests which would be generally regarded as affording differentiation within this group. [Earlier in the paper a classification is employed which has not this validity.] Thirty-six of these strains had the essential characters of typical *Bact. coli* (methyl-red positive, Voges-Proskauer negative, citrate negative, indol positive). Five strains were similar, except that the methyl-red reaction is recorded as doubtful. The Voges-Proskauer test was positive with one strain only, and only 3 strains grew in the citrate medium.

W. W. C. Topley.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 3.

Cecil, R. L., Nicholls, Edith E., & Stainsby, W. J. **Bacteriology of the Blood and Joints in Rheumatic Fever.** *J. Exper. Med.* 1929, v. 50, 617-42. [22 refs.] [Bellevue Hosp. & Cornell Clinic, New York City.]

The reports of those workers who have attempted to cultivate organisms from the blood and joints in cases of acute rheumatism have been very conflicting. Although some observers have recorded a high proportion of positive results, and the organisms isolated have, in nearly all cases, been streptococci, other workers have failed entirely to confirm these findings. Partly as a result of these discrepancies, there has been a tendency of recent years to seek for an explanation of the causation of the rheumatic syndrome as a toxæmic effect, produced by streptococci vegetating in the tonsil or elsewhere, or as an allergic reaction, following the absorption of bacterial antigens. The results recorded in this paper suggest that there is ample justification for pursuing the investigation of acute rheumatic infections along the lines of direct cultivation from the blood, and from the affected tissues. The technique adopted for blood culture consisted in the withdrawal of 20 c.c. or more of blood, which was divided into two equal portions and allowed to clot. Next day, after separation of the serum, each of the broken clots was transferred to 50 c.c. of heart-extract broth

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(pH 7·8) and incubated at 37° C. At 5-day intervals, for a period of one month, subcultures were made to blood-agar poured plates, and to tubes of blood broth, using a 0·1 c.c. inoculum in each case. Those cultures which gave no growth after one month were discarded as sterile. In preparing cultures from joints, the fluid was distributed in blood-broth tubes, and these were incubated and subcultured as in the case of the blood cultures. [The original paper should be consulted for exact technical details.]

The results obtained are summarized in Tables 4 and 5.

TABLE 4.—CLASSIFICATION OF PATIENTS STUDIED BY BLOOD CULTURES.

	Number of cases studied by blood cultures	Total	Streptococcus in blood cultures
Acute rheumatic fever	60	60	35
Controls :—			
Fever of unknown origin (blood culture positive)	1	66	1
Degenerative arthritis	23		
Gonococcal arthritis	4		
Chronic myositis	7		
Chronic neuritis	3		
Gout	2		
Chorea	2		
Tuberculous adenitis	2		
Diabetic neuritis	1		
Convalescent pneumonia	7		
Iridocyclitis	1		
Weak foot	1		
Chronic colitis	1		
Sciatica	1		
Gastric neurosis	1		
Chronic nephritis	1		
Neurasthenia	3		
Normal individuals	5		

TABLE 5.—CLASSIFICATION OF PATIENTS STUDIED BY JOINT CULTURES.

	Number of cases studied by blood culture	Total	Streptococcus in joint cultures
Acute rheumatic fever	7	7	5
Controls :—			
Degenerative arthritis	4	13	0
Gout	1		
Chronic synovitis	3		
Traumatic synovitis	4		
Osteoitis fibrosa cystica	1		

[The obvious criticism that the technique employed involved a serious risk of accidental contamination, such as has apparently vitiated many of the recorded instances of the cultivation of streptococci from brain or cord tissue in poliomyelitis, appears to be met by the striking difference between the results obtained in the rheumatic and control series.]

With two exceptions the streptococci recovered belonged to the *Str. viridans* group. One strain was definitely hæmolytic. One strain produced no change in blood media. Thirty-two strains from blood, and the 5 strains isolated from the joints, were tested as regards their fermentation reaction in dextrose, salicin, lactose, mannite and inulin. Thirty-four of the thirty-seven strains fermented dextrose, lactose, salicin and mannite. Three fermented dextrose, lactose and salicin, but had no effect on mannite. Of these three

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strains, one was the hæmolytic streptococcus, the other the indifferent strain. Only two strains in the entire series had any action on inulin; and in these cases the change in pH was so slight (pH 7·6-pH 7·2) as to be of very doubtful significance. [The author points out that, according to Holman's classification, the majority of these strains would be designated as *Streptococcus fæcalis*. Unfortunately their heat resistance, and their reducing action on dyes, were not tested; but it seems unlikely, in view of the consistent formation of methæmoglobin, that they would fulfil the criteria now commonly accepted as diagnostic of *Streptococcus fæcalis*, as a distinctive species.]

Agglutination tests indicated the existence of three well-marked antigenic groups among the strains isolated, with a considerable residue of heterogeneous strains. A point of considerable interest was the demonstration that in three cases, in which strains from the blood and joint fluid of the same patient were available, the two strains were in each case antigenically identical.

W. W. C. Topley.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 3.

The Collection and Disposal of Refuse: Chadwick Public Lecture at the Royal Sanitary Institute. By Mr. Edward Willis, M.Inst.C.E., F.S.I., etc., Chairman of the Royal Sanitary Institute. On Thursday, May 15, 1930.

The lecturer pointed out how collection of house refuse was entirely neglected until the last century, and other types of town refuse also received more or less scant consideration until the passing of the 1875 Act, except in special cities where private Acts of Parliament provided for sanitation.

The lecturer then traced the different types of refuse which had in the first instance to be collected to avoid causing ill-health to the neighbourhood, and explained that whilst motor transport was more efficient under certain conditions, the horse was more effective and economical for the actual house to house collection where the distance to the shoot was small.

He then dealt with the various means of disposal, including indiscriminate dumping, the use of destructors, pulverisors, dumping out to sea, and finally the advantages of controlled shoots, this method having been brought very much into prominence by the city of Bradford, and supported strongly in many instances by the Ministry of Health. He emphasized, however, that whilst a controlled dump was undoubtedly most efficient and economical in many instances, it was equally unsuitable and should never be applied on waterlogged ground, since it was liable to pollute the ground water. It was also unsuitable for certain water-bearing strata, but in many cases it was an exceptionally useful method of treatment. The indiscriminate dumping of refuse was a complete nuisance and should be absolutely stopped under all circumstances.

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Whilst the destructor served a very useful purpose, it was often desirable to screen the refuse before actual disposal, since the calorific value of the dust was probably only 2,500 B.T.U's, whereas the screened refuse would have a B.T.U. value of over 8,000. Again the actual dust screened out was valuable as salvage for brick burning.

The "salvage" question was a larger one than most people considered it, since any useful income from the collection or disposal of refuse was in effect "salvage," thus waste land, otherwise useless, when treated with refuse on the controlled principle was subsequently able to be used for cricket and football grounds, and brought in a regular income.

Dumping at sea was considered most undesirable. The lecture was illustrated with numerous slides tracing the gradual improvement that had been effected during the last fifty years.

Reviews.

THE PRINCIPLES OF BACTERIOLOGY AND IMMUNITY. By W. W. C. Topley, M.D., M.Sc., F.R.C.P., and G. S. Wilson, M.D., M.R.C.P., D.P.H. In two volumes. London: E. Arnold and Co. 1929. ($6\frac{1}{2} \times 9\frac{3}{4}$.) Vol. i, pp. xvi + 587 + xvi, 168 figures; vol. ii, pp. viii + 713 + xx, 74 figures. Price 50s. net the two volumes.

The study of bacteriology has advanced so rapidly and has so often been carried on in response to an emergency, with dramatically beneficial results, that there has been a great tendency to continue the work along purely utilitarian lines. The consequence is that the bacteriologist has been inclined to study those bacterial properties which are related to disease in man to the exclusion of those other phenomena connected with the life of the bacillus itself, which equally need to be mastered if the science of bacteriology is to be placed on a sure foundation.

Professor Topley and Dr. Wilson have set out to teach the student not only the connection between bacteria and disease but also some knowledge of bacteria as a distinctive class of living things, with their specialized methods of nutrition, metabolism, respiration and reaction to adverse surroundings.

Vast as was their undertaking, the authors have been eminently successful in treating the subject with surprising clearness and a thoroughness which will save the student much reference to other textbooks in the elucidation of points both elementary and abstruse.

The book is arranged in two volumes, the first of which deals chiefly with the study of bacteria *per se*, and the second with their activity in connection with the diseases of man and animals. Volume I is divided into two parts—general bacteriology and systematic bacteriology. The former opens with a short historical outline and then deals with the

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principles of bacterial physiology in its fullest sense. This is followed by chapters on serum reactions, bacterial variation, the classification of bacteria and general methods of identification. The chapter on physiology is very good and includes useful summaries on such things as the colloid state, surface tension, adsorption and the hydrogen ion concentration. The chapter on disinfection is most instructive and is typical of the book as a whole, in that it sets forth the general principles of the subject well supported by experimental data, and thus enables a worker to adapt his knowledge to any concrete problem that may arise.

The second part of Volume I deals with the descriptions of the different species and their classification. The cross absorption experiments by White have been summarized in tabular form, and the part played by antigen analysis in the arrangement of the Salmonella subgroup is clearly explained.

Volume II is also divided into two parts and deals with infection and resistance and the application of bacteriology to medical and hygienic problems. The question of the diagnosis of enteric fever, complicated as it is by the advent of antityphoid inoculation, is very clearly treated. Emphasis is laid upon the importance of fully appreciating the findings of Andrews and White with regard to antigenic structure of bacilli and of applying this knowledge when undertaking an investigation by the agglutination method.

The book is an admirable one, and supplies a long-felt want. In the case of the Army bacteriologist, whose reference library is necessarily limited, it should prove invaluable.

LABORATORY METHODS OF THE UNITED STATES ARMY. Edited by Charles F. Craig, M.A., M.D., Colonel, Medical Corps, United States Army. 1929. Lea and Fibiger. Pp. vii + 696. $3.50.

The size of this work is 6 inches by 4 inches, and it is four-fifths of an inch thick. That means to say no very large pocket is required to hold it. It contains in that very small space 696 pages of good-sized print.

This manual has already run through two previous editions, and the third one, now under notice, has been entirely revised and rewritten. It contains, within the above-mentioned small space, all the laboratory methods in use in the U.S.A. Army Laboratories and at the Army Medical School. Colonel Craig has been aided in his labours by such well-known men as (to mention only a few) Dr. Van Slyke, Dr. Murphy and Dr. G. MacCullum. The result is the publication of a work which is without rival as a bench-book, and which can give rise to nothing less than astonishment at the amount of information available within its limited space.

Consideration of the contents will be sufficiently impressive. The work is divided into "parts." Part I deals with clinical pathological methods, and includes the examination of urine, blood, stomach-contents

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and fæces. Included also in this section is a chapter on blood chemistry, which is as complete in technical detail as, say, Beaumont and Dodds' work on the same subject. There is also a chapter on basal metabolism and another on the serological diagnosis of syphilis.

Part II is an introduction to general bacteriological methods, methods of cultivation and staining. Part III goes more fully into the diagnosis of specific bacteria. Part IV is concerned with the chemical examination of water and sewage, whilst that of milk, butter, meat, etc., comes in Part V.

Parts VIII, IX and X deal with protozoological, helminthological and entomological methods. Post-mortems and the technique of histological pathology come under Part XI, and Part XII is concerned with veterinary pathology. The work concludes with a very full and, so far as we can ascertain, a very carefully prepared index.

The synopsis given above indicates to what an extent the ground has been covered. In a busy laboratory, that is to say, in one concerned with assisting the clinical side of hospital treatment, the tests the worker is called upon to carry out are now so numerous and so varied, that it is hardly safe for the one worker to attempt to trust to his memory for working out his problems. A bench-book of some sort is essential; and in this country hitherto, in this class of work, the need has been, unfortunately, for several bench-books. Here then is a book to hand. The reviewer can think of no method, that is recognized and standardized, which is not touched upon somewhere in this small work.

On the other hand, one cannot but fail to realize what a task the editor must have had to keep his book within limits. The calls on his space have been insistent; but there is little that he could have omitted without sacrificing its complete usefulness.

Certain sections may be examined in greater detail. The method for the determination of the total acetone bodies in blood or urine is very well explained, whilst the method of Behre and Benedict, which is more recent and shorter than that of Van Slyke and Fitz, is given as an alternative. This of course is a colorimetric one.

Means for the investigation of kidney function are dealt with very fully, though whether Gutzeit's test for the presence of arsenic will stand the test of time remains to be seen. The details of Tanret's and Mayer's tests for quinine are mentioned. It is noticeable that no method is suggested for the estimation of quinine concentration in blood.

The biochemistry of the blood is naturally principally investigated by colorimetric methods, and the various details are given to enable any decently equipped clinical laboratory to furnish a very complete report to an inquisitive clinician.

The fat-splitting potential is investigated, but the normal range is not given. It may be that the editor finds the limits so wide as to be unworthy of mention. Hydrogen-ion concentrations are measured by colorimetric

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means, but no mention is made of arriving at a determination very rapidly and very accurately by electrometric methods, nor is mention made in the bacteriological section of any of the selective media for picking out *C. diphtheriæ*. Some workers have been very struck with the value of certain tellurite media.

The detail of absorption tests is given. This technique does not always find a place in English textbooks.

"Rawlings," who surely needs a brass plate to his immortal memory in the precincts of Grosvenor Road, receives that honourable mention which is his due.

We are content with the newer nomenclature. Is it therefore necessary to refer to *Brucella melitensis*, even in brackets, as *Alkaligenes melitensis*? Is it sound to refer to *Br. abortus* as a "var." of *melitensis*? The calculation of the agglutinins absorbed is given a place in this difficult problem of parent and variant.

The war-wound anaerobes receive full attention, and we are not surprised to find that the question of hypersensitiveness is fully debated rather unnecessarily. But our American colleagues have always been intrigued with the problem. The chemical examination of water, sewage and of foods is considered on conventional lines. Refractometric methods of analysis are only mentioned under the examination of the alcohols. Zeiss-immersion readings occupy a whole page.

In conclusion, there will be no officer whose laboratory is mounted on a lorry chassis, at pains at all times to find room for his impedimenta, who will not be eternally grateful to Colonel Craig for the gift of this *multum in parvo*. There will, in fact, be very few laboratory workers anywhere, no matter how well off they may be for room or even library facilities, who will neglect to add this work to their bench. There may be some of us who are a little jealous of the enterprise of the Laboratory Section of the Medical Department of the United States Army, and who envy it the assistance given it by its Government in the matter of funds, but there will be none who will not congratulate Colonel Craig and his fellow-workers on the production of a wonderful little book. D. S. S.

Notice.

THE BEHRING VENULE.

Messrs. Bayer Products, Ltd., have submitted samples of the "Behring Venule." This is an automatic aspirating syringe for the collection of blood or other body fluids for pathological investigation.

The device consists of a strong glass tube of eight cubic centimetres capacity, from which the air has been exhausted; it is closed by a perforated rubber stopper carrying a thin glass tube containing a sharp steel cannula.

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The glass tube passing through the rubber stopper is bent at a right angle in such a manner that the short limb has its open end pressed against the inner wall of the rubber stopper. The contact between the glass tube and the stopper thereby forms a sort of valve which is kept constantly closed by the elasticity of the rubber. This valve is opened by firm pressure on the angle formed by the glass tube and the receiver.

For use in abstracting blood the glass tube covering the needle is cut with a file and removed. The needle is then inserted into a vein and by means of a slight but definite pressure the valve is opened, whereupon the blood is aspirated into the tube. When sufficient has been collected the pressure is relaxed, allowing the valve to close and the needle is



Fig. 1.—Venule before use.



Fig. 2.—Sectional view—ready for use.

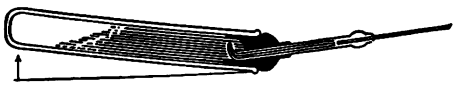


Fig. 3.—Sectional view—valve opened in use.

withdrawn from the vein. The glass tube holding the needle can now be cut off short and the venule is then ready to be packed and despatched to the laboratory without further treatment as the rubber and glass valve forms an efficient seal.

We have found in practice that it is remarkably easy to take a sterile sample of blood single-handed in this way. The saving in time and trouble when the patient cannot come to the hospital or laboratory is obvious and well worth the small cost of the device.

Besides the simple empty form described above, thirteen other kinds of venule are supplied, among which we may mention, as being particularly useful to the medical officer, those containing sterile ox-bile medium or nutrient broth for blood-cultures.

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VOL. LV. AUGUST, 1930. No. 2.

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Journal
of the
Royal Army Medical Corps.

Original Communications.

THE FLOCCULAR AND GRANULAR AGGLUTININS IN TYPHOID FEVER.

BY MAJOR N. T. WHITEHEAD, M.C.,
Royal Army Medical Corps.

AN outbreak of typhoid fever in the South West district of London during the latter part of 1929 supplied the opportunity of estimating the floccular ("H") and granular ("O") agglutinins in the blood of a number of cases, both during their illness and some months after their recovery. None of these patients had been inoculated. It was also possible to compare the results with the agglutinins to be found in the blood of soldiers who had been given antityphoid inoculation at some time during their service. These inoculated controls were men who for some reason or another had been sent to one of the army laboratories for blood-tests.

The interest of this investigation lies in the opportunity it affords for estimating the value of "the qualitative receptor analysis" as a means of diagnosing enteric fever, and in the production of certain observations which have a distinct bearing on immunity in general.

In the following article it will be necessary to give some value to the agglutinin content of a serum, and this is best done by simply quoting the denominator of the final dilution in which a standard agglutination has occurred; in the same way it is possible to give a value to the average amount of agglutinin in a group of sera.

I.

The method advocated by Felix (1924) for serologically differentiating between a typhoid case and an inoculated man not infected with *B. typhosus* depends for its applicability on two fundamental principles :—

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(1) That "O" agglutinins are more closely identified with the actual disease than the "H" agglutinins.

(2) That "O" agglutinins are not produced by inoculated persons to any significant extent.

The results obtained in this investigation amply confirm the first, whilst only partially agreeing with the second of these principles.

In proof of the first principle it will be seen, by referring to Tables I and II, that if the "H" and "O" agglutinins of the typhoid cases and of the inoculated men are averaged the following will be the values of each :—

	"H" agglutinins	"O" agglutinins
Average of 15 typhoid cases	710 ..	651
Average of 54 inoculated men	515 ..	49

Thus the disease and the inoculation produce comparable amounts of "H" agglutinin, whereas the disease produces twelve times as much "O" agglutinin as does inoculation, proving that the "O" agglutinins are more closely identified with the disease than are the "H" agglutinins.

With regard to the second principle referred to above, it is obvious from the figures quoted that the amount of "O" agglutinin in the average typhoid case greatly exceeds the amount in the average inoculated man, but Tables I and II show that certain individual cases of typhoid fever possess no more "O" agglutinins than do certain healthy inoculated persons. This point is illustrated by Nos. 2, 5, 9, 10, 12, 14, 15, in Table I, and Nos. 19, 30, 31, 38, 39, 42, 52, 58, 61, 62, in Table II.

There are two possible reasons for these facts :—

(1) That a proportion of inoculated persons *have* produced a significant amount of "O" agglutinin.

(2) That a number of proved cases of typhoid fever, amounting to forty-four per cent of those examined, have failed to produce a significant amount.

Either of these reasons for the observed facts tends to limit the general application of Felix's differential method of diagnosis.

An attempt has been made to find out what amount of "O" agglutinins may be justifiably considered to be significant of some association with the typhoid antigen. For this purpose the blood of sixty-seven normal uninoculated persons has been examined, and the results are summarized in Table III. It will be noticed that "O" agglutination took place in a dilution of 1 in 50 twice. None of these cases gives any history of having had typhoid fever, and one must therefore assume that no significance can be attached to granular agglutination in a dilution of less than 1 in 125 with the particular "O" suspension in use during this investigation.

If, therefore, the dilution of 1 in 125 is taken to be the dilution of "significance," it will be seen that ten, that is about twenty per cent of the inoculated men, showed a significant amount of "O" agglutinin. The estimation of "O" agglutinins would appear, therefore, to have its limitations as a means of eliminating uninfected inoculated persons.

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In this connexion Case No. 4 is of particular interest in that the "H" agglutinins were entirely absent during the first few weeks of illness, and the case could only have been diagnosed serologically by estimating the "O" agglutinins. Similar cases have been reported in Palestine (Felix, 1924), in South Africa (Pijper, 1930), and in England (Gardner, 1930).

II.

The lack of a reliable test for immunity against typhoid fever has continually handicapped work in connexion with prophylactic vaccination, and it appears a suitable opportunity for attempting to find some common "function" present in the blood of persons who are immune or partially immune and which is absent from the blood of the entirely unprotected.

The agglutinins are an obvious field for investigation, and of the two kinds the "O" agglutinin seems the most promising, because it has been shown to be more closely connected with the actual disease, and because it has been proved experimentally that the "O" portion of an organism is the one chiefly concerned in the production of artificial immunity. (Felix, 1924; Arkwright, 1927; Topley, 1929.)

Reference to Tables I, II and III shows :—

(1) That during the actual course of typhoid fever, "O" agglutinins are very prominent in the blood; (2) that a proportion of inoculated persons show a significant amount of "O" agglutinins; and (3) that none of the non-inoculated persons examined shows any significant amount of "O" agglutinins.

Here, then, would seem to be a satisfactory test of immunity, but if reference is again made to Table I it will be seen that out of ten cases that were tested six months after their recovery from typhoid fever only two showed a significant amount of "O" agglutinin (see Nos. 1 to 10, Table I). Their immunity, however, was presumably quite as good, if not better, at this time than during the first few weeks of the disease.

For these reasons it is obvious that the presence of "O" agglutinins in the blood cannot be accepted as the only criterion of immunity.

It has been suggested by Topley that "the ability to produce antibodies briskly and in large amounts in response to a relatively slight specific stimulus may be just as effective from the point of view of potential immunity as the possession of an adequate supply of preformed antibodies in the blood and tissue fluids."

If this surmise is correct, it should not be difficult to formulate some test by which the rate of antibody response to a minimal stimulus may be suitably measured and used as an indication of the amount of immunity possessed by an individual.

III.

The details of the tests here recorded are as follows :—

Floccular ("H") agglutinins were demonstrated by using an agglutinating suspension which had been standardized against the Oxford standard emulsion and had a suspension factor of 7·3.

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The highest dilution to show Dreyer's standard agglutination, after two hours in a water bath at 56° C., was taken as indicating the "H" agglutinin content of a serum.

Granular ("O") agglutinins were demonstrated by using an alcoholized suspension of a strain of *B. typhosus* (O.901) kindly given me by Dr. Felix, from whom I have received every kind of assistance.

Gardner's method is the one employed in making up the alcoholized emulsion, and a sufficient quantity was made to last the whole period of the investigation.

TABLE I.—Showing the Floccular ("H") and Granular ("O") Agglutinins in the Blood of Persons During and After an Attack of Typhoid Fever.

Number	Day of disease	"H" agglutination	"O" agglutination	Particulars
1	14th	1/1,250	1/500	*B. typhosus* in stool. Moderately severe.
	After 6 months	1/50	*Nil*	
2	11th	1/65	1/125	*B. typhosus* in blood and stool. Severe, relapse and hæmorrhage.
	After 6 months	*Nil*	1/50	
3	16th	1/1,250	1/500	*B. typhosus* in stool. Moderately severe.
	After 6 months	1/32	1/50	
4	25th	*Nil*	1/1,250	*B. typhosus* in stool. Severe, delirium, high fever.
	After 6 months	1/500	1/250	
5	23rd	1/125	1/25	*B. typhosus* in stool. Severe, two relapses.
	After 6 months	*Nil*	1/50	
6	18th	1/365	1/2,500	*B. typhosus* in stool. Severe, delirium, high fever.
	After 6 months	*Nil*	1/50	
7	50th	1/645	1/500	*B. typhosus* in stool. Moderately severe.
	After 6 months	1/73	1/125	
8	41st	1/5,000	1/500	*B. typhosus* in urine. Moderately severe.
	After 6 months	1/25	*Nil*	
9	16th	1/730	1/250	Agglutinated *paratyphosus* A, 1/25.
	After 6 months	1/73	1/50	No agglutination with *paratyphosus* B or *melitensis*. Mild attack.
10	18th	1/250	1/125	No agglutination with *paratyphosus* A, B, or *melitensis*.
	After 6 months	1/25	*Nil*	Moderately severe.
11	10th	1/250	1/500	*B. typhosus* in blood. Moderately severe.
12	10th	1/50	1/250	*B. typhosus* in stool. Moderately severe.
13	21st	1/500	1/2,500	*B. typhosus* in stool. Moderately severe.
14	19th	1/125	1/125	No agglutination with *paratyphosus* A. B, or *melitensis* Moderately severe.
15	16th	1/50	1/125	No agglutination with *paratyphosus* A, B, or *melitensis*. Very severe—died from perforation.

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TABLE II.—Showing Flocculer ("H") and Granular ("O") Agglutinins in the Blood of Inoculated Soldiers.

Number	When inoculated	"H" agglutination	"O" agglutination	Remark
18	15 months previously	1/1,500	—	*
19	14 ,, ,,	1/250	1/125	P.
20	12 ,, ,,	1/125	1/25	P.
21	12 ,, ,,	1/250	1/25	—
22	9 ,, ,,	1/125	—	—
23	9 ,, ,,	1/280	1/50	—
24	8 ,, ,,	1/28	—	*
25	8 ,, ,,	1/280	1/50	*
26	8 ,, ,,	1/250	1/25	*
27	7 ,, ,,	1/325	1/50	*
28	7 ,, ,,	1/56	1/25	*
29	6 ,, ,,	1/2,500	—	—
30	6 ,, ,,	1/50	1/125	P.
31	6 ,, ,,	1/325	1/250	—
32	6 ,, ,,	1/50	1/50	—
33	6 ,, ,,	1/300	—	—
34	6 ,, ,,	1/280	1/25	*
35	5 ,, ,,	1/500	1/25	—
36	5 ,, ,,	1/500	—	*
37	4 ,, ,,	1/125	1/50	—
38	4 ,, ,,	1/250	1/250	—
39	4 ,, ,,	1/125	1/125	—
40	4 ,, ,,	1/500	—	*
41	3 ,, ,,	1/125	1/25	—
42	3 ,, ,,	1/250	1/125	—
43	3 ,, ,,	1/125	1/50	—
44	2 ,, ,,	1/125	1/25	P.
45	2 ,, ,,	1/125	1/25	—
46	2 ,, ,,	1/500	1/50	—
47	2 ,, ,,	1/125	—	P.
48	2 ,, ,,	1/322	1/50	—
49	1 ,, ,,	1/500	1/25	—
50	1 ,, ,,	1/50	1/50	—
51	1 ,, ,,	1/250	—	P.
52	1 ,, ,,	1/1,250	1/125	—
53	1 ,, ,,	1/50	1/25	—
54	1 ,, ,,	1/2,500	—	—
55	1 ,, ,,	1/2,500	1/50	—
56	1 ,, ,,	1/250	—	—
57	1 ,, ,,	1/500	1/50	—
58	1 ,, ,,	1/250	1/125	—
59	1 ,, ,,	1/125	1/25	—
60	1 ,, ,,	1/1,250	1/50	—
61	1 ,, ,,	1/1,250	1/125	*
62	1 ,, ,,	1/500	1/250	*
63	1 ,, ,,	1/125	1/50	—
64	1 ,, ,,	1/250	—	—
65	1 ,, ,,	1/500	1/25	—
66	1 ,, ,,	1/125	—	—
67	1 ,, ,,	1/1.250	1/25	—
68	? ,, ,,	1/125	—	—
69	? ,, ,,	1/645	—	—
70	? ,, ,,	1/300	—	—
71	? ,, ,,	1/1,612	1/50	—

Note 1.—All the soldiers have been inoculated more than once except those marked "P," who have only received their first full inoculation, that is to say, two injections of ½ and 1 c.c. at ten days' interval.

Note 2.—Those marked with an * gave no history of having ever suffered from enteric fever, and it must be noted that two out of the eleven of these men show a significant amount of "O" agglutinins, but as regards the remainder of the men they were not questioned on this point.

It is conceivable that a person with a previous history of enteric fever would be more likely to produce "O" agglutinins after inoculation than a person with no such history, but in view of the fact that these men were quite young soldiers, it is permissible to regard the incidence among them of a past history of enteric as being the same as it would be among a civilian population in the British Isles. This incidence would, I submit, make no real difference to the conclusions that have been drawn in this article.

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The "O" agglutinin content of a serum was indicated by the highest dilution in which clear-cut granulation could be seen in the supernatant fluid with a watchmaker's glass (by $3\frac{1}{2}$) after the tubes had been eighteen hours in a water bath at 56° C.

Besides the usual saline control tube with each serum tested, the alcoholized suspension was put up against a range of saline concentrations both at the beginning and the end of the investigation, and there was no sign of any salt agglutination (Arkwright). The strengths of saline used in these tests were as follows: 0·85 per cent, 1·7 per cent, 3·4 per cent, 6·8 per cent.

TABLE III.—Giving a Summary of the Floccular ("H") and Granular ("O") Agglutinins in the Blood of Sixty-seven Uninoculated Normal Persons taken at Random.

Number of cases	Dilution in which the standard "O" agglutination occurred
12	1/25
2	1/50
53	No "O" agglutination
67	

None of the 67 persons gave any "H" agglutination at all.

The alcoholized suspension was also tested against a pure typhoid "O" serum and it granulated up to 1/5,000, which was the titre of the serum. It was also tested against a typhoid serum in which the "H" antibody was greatly in excess, the flocculation titre being 1/10,000. In this case the suspension gave a granulation up to 1/1,000, but there was no sign of any flocculation.

These control tests give ample proof that the alcoholized suspension used during this investigation was a stable suspension, which was unaffected by floccular agglutinins but reacted well with granular agglutinins.

Summary and Conclusions.

(1) That "O" agglutinins are more closely identified with the actual disease of typhoid fever than are "H" agglutinins.

(2) That in a large proportion of cases the estimation of the "O" agglutinins provides a method of differentiating a typhoid case from an inoculated person uninfected with the disease.

(3) That this method has definite limitations.

(4) That the presence of "O" agglutinins in the blood is some indication of immunity.

(5) That the absence of "O" agglutinins in the blood is no proof that there is no immunity.

(6) That the significance of immunity may lie in the ability to produce a large amount of antibody rapidly and in response to a minimal stimulus.

(7) That the rate of antibody response to a minimal stimulus might supply the much-needed test for immunity.

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My thanks are due to Colonel A. C. H. Gray for his advice and for his permission to publish this article.

Addendum.

Since the above was written I have examined an additional 30 sera from inoculated soldiers, none of whom gives any past history of enteric fever. Amongst these men there were four who showed a significant amount of "O" agglutinin.

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A STUDY OF CERTAIN FEATURES IN CONNECTION WITH ENTERIC GROUP INFECTIONS IN THE ARMY IN INDIA.

By Major J. A. MANIFOLD, D.S.O.,
Royal Army Medical Corps.

(*Continued from p.* 15.)

(1) Dosage for Re-inoculation with T.A.B. Vaccine.

The Regulations for the Army in India have laid down up to the present date that inoculation shall be carried out by two doses of ½ and 1 c.c. T.A.B. vaccine, the second dose being given ten days after the first. Re-inoculation is to be given at the end of eighteen months with a single dose of 1 c.c. and a similar dose at yearly intervals for all future re-inoculations.

Several cases have arisen during the past three years in the experience of the writer, and of several other workers in military laboratories, which were disturbing in that cases of typhoid and enteric group infection followed closely on inoculation or, more usually, re-inoculation.

Of 22 cases of typhoid which occurred during 1926 in Quetta in one regiment 19 had been recently re-inoculated. Pathologists have been inclined to question the efficacy of the vaccine employed, and to refer to occasional severe toxic cases which occurred shortly after inoculation as a proof of the failure of the vaccine to protect, particularly against *B. typhosus*. The incidence of typhoid among British troops, however, has remained comparatively steady for several years, and although the incidence among Indian troops greatly increased during the year 1928 (Table I), the increase is almost certainly due to the energetic investigations carried out by certain pathologists and physicians who were taking a great interest in the mild pyrexias among the Indian troops during this year. Had the increase been a real one, and due to any failure on the part of the vaccine, it is impossible to believe that British troops would not have been equally involved. Further, a study of the A.F. I 3056 shows that although a certain small percentage of severe cases have occurred shortly after inoculation or re-inoculation, such cases are restricted to no particular period.

The majority of the cases coming under the writer's observation were in individuals who had been re-inoculated with the 1 c.c. dose, and that this dose is too large and induces a prolonged negative phase has been his opinion for some three years. Proof, however, has been difficult to obtain. Cases also occur in which infection has followed shortly after inoculation with two doses, and as a result the impression gained from individual experience was only of a general nature. Modern opinion has also been

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tending towards the belief that the danger of a negative phase has been much exaggerated in the past, on what grounds is not known, as although the statement is widely made, the reasons for accepting this view seem to be conspicuous by their absence.

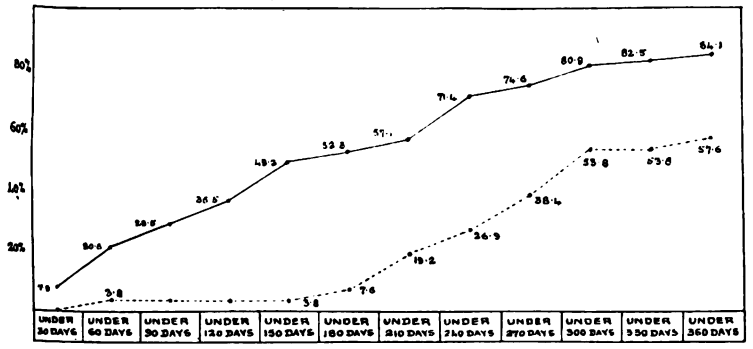
In a leading article in the *Lancet* of September 1, 1928, we find the

TYPHOID FEVER—BRITISH TROOPS—1927 AND 1928.

PERCENTAGE OF INFECTIONS IN FIRST TWELVE MONTHS AFTER INOCULATION.

INOCULATED WITH ONE DOSE ——— (63 CASES).

INOCULATED WITH TWO DOSES - - - - - - (26 CASES).



ACTUALS

	ONE DOSE.	TWO DOSES.
UNDER 30 DAYS	5	—
" 60 "	13	1
" 90 "	18	1
" 120 "	23	1
" 150 "	31	1
" 180 "	33	2
" 210 "	36	5
" 240 "	46	7
" 270 "	47	10
" 300 "	51	14
" 330 "	52	14
" 360 "	53	15

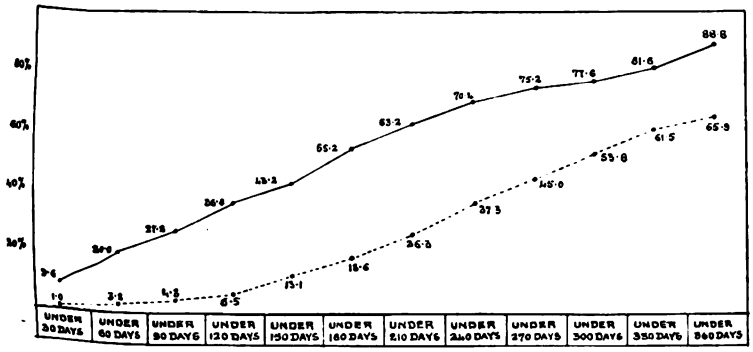
N.B.—Cases which occurred after 360 days have not been included in this chart.

ENTERIC GROUP—BRITISH TROOPS—1927 AND 1928.

PERCENTAGE OF INFECTIONS IN FIRST TWELVE MONTHS AFTER INOCULATION.

INOCULATED WITH ONE DOSE ——— (125 CASES).

INOCULATED WITH TWO DOSES - - - - - - (91 CASES).



ACTUALS

	ONE DOSE.	TWO DOSES.
UNDER 30 DAYS	12	1
" 60 "	25	3
" 90 "	34	4
" 120 "	46	6
" 150 "	84	12
" 180 "	63	17
" 210 "	73	24
" 240 "	88	34
" 270 "	94	41
" 300 "	97	43
" 330 "	102	56
" 360 "	111	60

N.B.—Cases which occurred after 360 days have not been included in this chart.

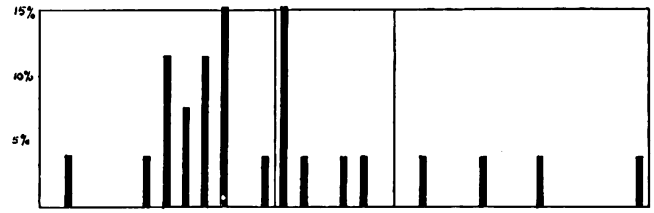
following: "Inoculation is believed to be followed by a 'negative phase' in which the subject's resistance is somewhat lowered, and this might be regarded as endangering individuals who are given typhoid vaccine while exposed to infection. It is hard to say when this phase begins and ends, but its significance has probably been much exaggerated."

It should be pointed out that in the same article it is stated that the

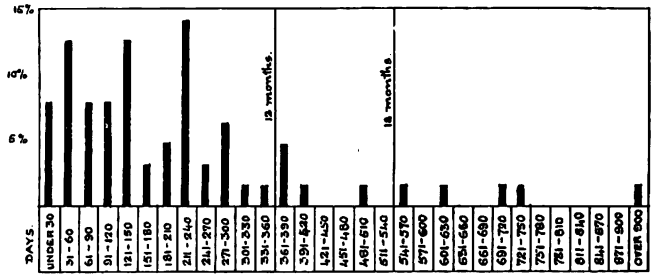
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TYPHOID FEVER—BRITISH TROOPS—1927 AND 1928.

TWO-DOSE INOCULATIONS—26 CASES.



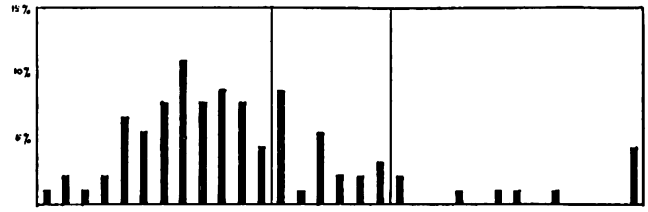
ONE-DOSE INOCULATIONS—63 CASES.



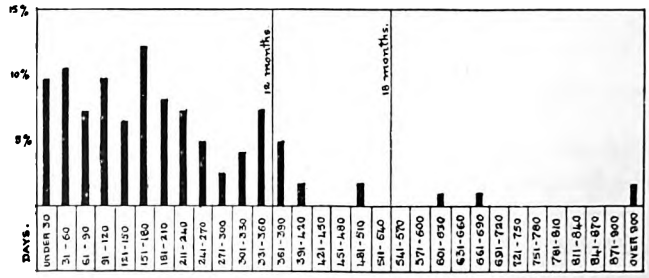
Period elapsed between last inoculation and date of onset of disease.

ENTERIC GROUP—BRITISH TROOPS—1927 AND 1928.

TWO-DOSE INOCULATIONS—91 CASES.



ONE-DOSE INOCULATIONS—125 CASES.



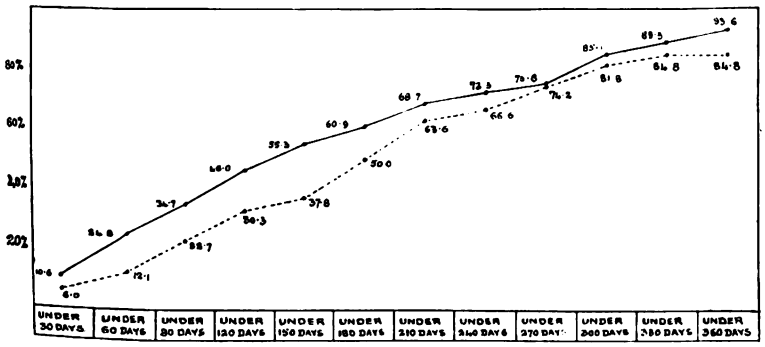
Period elapsed between last inoculation and date of onset of disease.

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Army dose is probably too great for the average civilian, and that the immunity produced by repeated small doses would probably be better than by two large doses.

It was thought that some information bearing on this subject might be obtained from the study of the inoculation history of a large group of cases

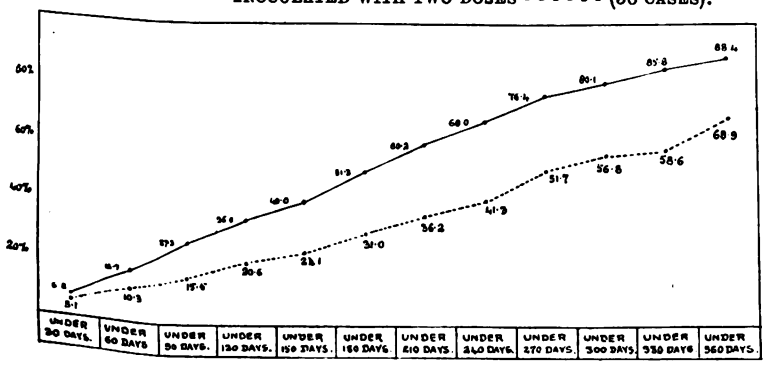
TYPHOID FEVER—INDIAN TROOPS—1927 AND 1928.
PERCENTAGE OF INFECTIONS IN FIRST TWELVE MONTHS AFTER INOCULATION.
INOCULATED WITH ONE DOSE ———— (141 CASES).
INOCULATED WITH TWO DOSES - - - - - - (66 CASES).



ACTUALS		
UNDER 30 DAYS	15	4
" 60 "	36	8
" 90 "	49	15
" 120 "	65	20
" 150 "	78	25
" 180 "	86	35
" 210 "	97	42
" 240 "	102	44
" 270 "	107	49
" 300 "	120	54
" 330 "	126	56
" 360 "	132	56
	ONE DOSE.	TWO DOSES.

N.B.—Cases which occurred after 360 days have not been included in this chart.

ENTERIC GROUP—INDIAN TROOPS—1927 AND 1928.
PERCENTAGE OF INFECTIONS IN FIRST TWELVE MONTHS AFTER INOCULATION.
INOCULATED WITH ONE DOSE ———— (191 CASES).
INOCULATED WITH TWO DOSES - - - - - - (56 CASES).



ACTUALS.		
UNDER 30 DAYS	13	3
" 60 "	32	6
" 90 "	52	9
" 120 "	67	18
" 150 "	76	14
" 180 "	96	18
" 210 "	115	21
" 240 "	130	24
" 270 "	146	30
" 300 "	163	33
" 330 "	184	34
" 360 "	169	40
	ONE DOSE.	TWO DOSES.

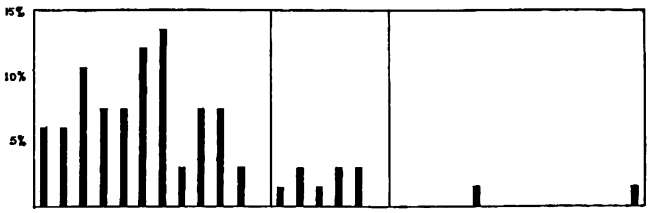
N.B.—Cases which occurred after 360 days have not been included in this chart.

of enteric group infections. It would be possible to ascertain the percentages of the total cases which occurred during the various periods of thirty days after inoculation both for " one dose " and " two dose " cases. Inoculation details of 819 cases are available : 558 cases reinoculated with 1 c.c., and 261 cases inoculated with two doses of $\frac{1}{2}$ and 1 c.c. Probably a few

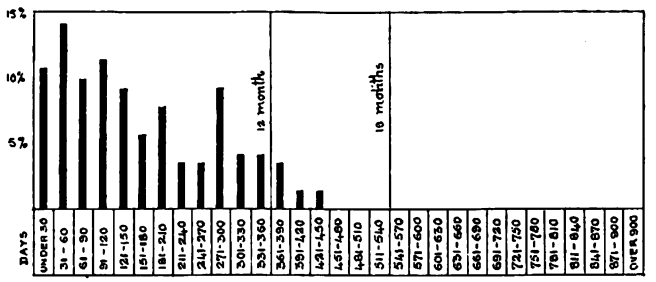
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TYPHOID FEVER—INDIAN TROOPS—1927 AND 1928.

TWO-DOSE INOCULATIONS—66 CASES.



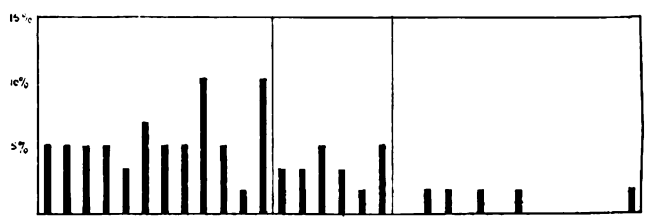
ONE-DOSE INOCULATIONS—141 CASES.



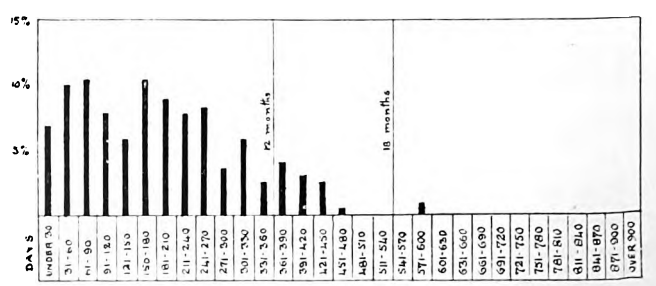
Period elapsed between last inoculation and date of onset of disease.

ENTERIC GROUP—INDIAN TROOPS—1927 AND 1928.

TWO-DOSE INOCULATIONS—58 CASES.



ONE-DOSE INOCULATIONS—191 CASES.

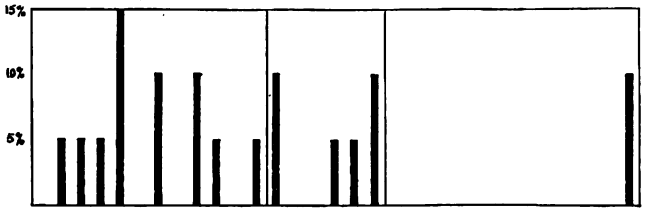


Period elapsed between last inoculation and date of onset of disease.

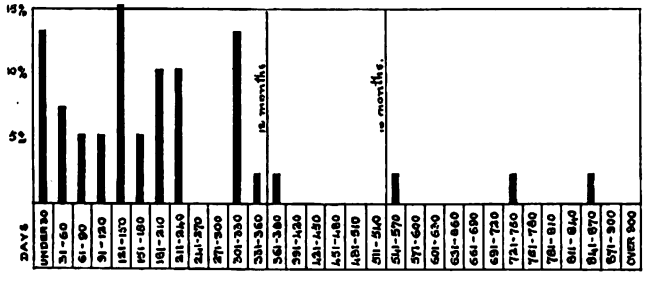
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of these latter cases are also re-inoculations, but the very great majority are recruits among Indian troops, or British troops inoculated for the first time in England prior to proceeding to India.

PARATYPHOID FEVER "A"—BRITISH AND INDIAN TROOPS—1926, 1927 AND 1928.
TWO-DOSE INOCULATIONS—20 CASES.

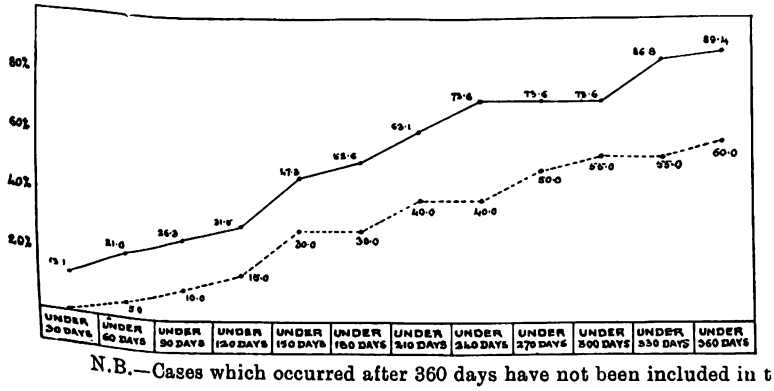


ONE-DOSE INOCULATIONS—36 CASES.



Period elapsed between last inoculation and date of onset of disease.

PARATYPHOID FEVER "A"—BRITISH AND INDIAN TROOPS—1926, 1927 AND 1928.
PERCENTAGE OF INFECTIONS IN FIRST TWELVE MONTHS AFTER INOCULATION.
INOCULATED WITH ONE DOSE ———— (38 CASES)
INOCULATED WITH TWO DOSES - - - - - (20 CASES)



ACTUALS		
UNDER 30 DAYS	5	—
" 60 "	5	1
" 90 "	10	2
" 120 "	12	3
" 150 "	18	6
" 180 "	20	6
" 210 "	24	8
" 240 "	28	8
" 280 "	28	10
" 300 "	28	11
" 330 "	33	11
" 360 "	34	12
	ONE DOSE.	TWO DOSES.

N.B.—Cases which occurred after 360 days have not been included in this chart.

Graphs were, therefore, prepared for separate groups for the years 1927 and 1928, but as the "two dose" cases appeared too few to act as a proper control, he typhoid and enteric group cases for these years, and the

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paratyphoid A cases, British and India, for 1926, 1927 and 1928, are grouped together.

The results to the writer appear striking in that cases who have received two doses are found to contract infection in a small percentage only during the first six months after inoculation, which is as would be expected, whereas the percentage among the re-inoculated is higher during the first six months after re-inoculation. The high percentages of cases which occur between the 30th and 60th day in those inoculated with the one large dose appears very significant of a definite and prolonged negative phase. The significance is heightened by the fact that all the individuals receiving this dose had been inoculated eighteen months previously with two doses or twelve months previously with one dose, and would be expected to retain a certain amount of protection, whereas those receiving two doses are mainly young British adults comparatively recently arrived in India, or Indian recruits who have recently joined the Army, both presumably more susceptible to infection.

There may possibly be some other explanation of these figures, but it seems hard not to believe that by using the 1-c.c. dose, in lieu of conferring protection, we are actually destroying a protection which already exists.

This may appear rather an extreme statement, but attention is directed to the graphs which give full details of the percentage of cases occurring at the different periods, and the histograms illustrating the actual number of cases per thirty day periods. The percentage of cases which occurred after 360 days is not shown in the graphs owing to the small numbers occurring after this date.

From an examination of the graphs it will be seen that the effect of the large dose appears to be greater among British troops than Indian, although a similar picture is seen among the latter group, but to a slighter degree.

Among British troops (typhoid) 1927, 1928, we find that 52·3 per cent of those who contracted infection had been re-inoculated with one large dose within six months, whereas only 7·6 per cent of cases infected during this period had been inoculated with two doses. As many as 7·9 per cent of the cases contracted typhoid within thirty days of re-inoculation with one dose, and 20·6 per cent within sixty days.

The enteric group figures are almost identical, viz., 55·2 per cent one-dose group as against 18·6 per cent of the two-dose group within six months. 9·6 per cent of the one-dose group contracted their infection within thirty days of re-inoculation, and again there is the jump to 20 per cent as against 3·2 per cent in the two-dose group for the sixty-day period.

Among the Indian troops the curve for the two-dose cases shows a steadier rise than in the case of the British troops, but the same picture is seen in a minor degree. The percentage among the one-dose cases of

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typhoid for the sixty day period is double that of the two-dose cases, and in both typhoid and enteric groups there is a high percentage of infection within the first three months in the one-dose cases.

Owing to the few inoculation details available for paratyphoid A cases, it has been necessary to group British and Indian cases together, but the graph appears equally striking, 13·1 per cent cases in the one-dose group occurring within thirty days of re-inoculation. A similar rise to 21 per cent in the sixty-day period, as compared with 5 per cent among two-dose cases, and 52·6 per cent present as against 30 per cent in the first 180 days after inoculation is found. It seems, therefore, that the negative phase in a country in which infection is rife is not to be disregarded, and instructions have already been issued by the Director of Medical Services in India abolishing the 1-c.c. single dose for the Army in India.

Harvey and Iyenger [30], using fowl cholera vaccine in experimental studies on artificial immunity in pigeons, appear to have shown that immunity may be reproduced in inoculated pigeons, in which the original immunity has been allowed to die out, by doses $\frac{1}{8}$th to $\frac{1}{16}$th of the original dose. It does not follow that similar results will result in re-inoculation of human beings with T.A.B. vaccine, but in many instances during the past three years individual cases have been re-inoculated with doses of $\frac{1}{4}$ and $\frac{1}{2}$ c.c. in order to avoid the unpleasant reaction which may result from the larger dose, apparently with excellent results. It appears highly probable that this dose used for re-inoculation would give ample protection.

Granted that the production of agglutinin is no indication of the extent of existing protection, as appears to be accepted generally in these days, it is still interesting to observe cases in which non-enteric pyrexias have produced a definite drop in inoculation agglutinin content, and we have seen that the same phenomenon occurs in true enteric infections, frequently to be followed by a definite rise, but not in all cases. It seems possible that a reaction indicated by inflammation at the site of inoculation and a general pyrexia of short duration after inoculation may be phenomena to avoid instead of imagining, as the writer has frequently heard it stated that such symptoms are an indication of a good response to re-inoculation.

Although the 1-c.c. dose appears to have led to an increased susceptibility to infection, the subsequent attack does not appear to have been more severe than is found in the ordinary run of inoculated cases. In the group of cases under consideration the percentage of severe cases was 31·7 per cent in the 1-c.c. group, and 31·3 per cent in the $\frac{1}{2}$ and 1-c.c. group. In the 42 cases which occurred between the 61st and 90th day after inoculation, 12 out of 33 (36·3 per cent) cases re-inoculated with 1 c.c. are noted as severe, and 3 out of 9 (33·3 per cent) cases inoculated with $\frac{1}{2}$ and 1 c.c. T.A.B. are placed in a similar category. Table II, which is an extract from the command report of the Sanitary Commissioner with the Government of India for 1916, is inserted as of interest in the

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discussion on this question. Inoculation for the period referred to in this Table was carried out with the usual two doses of vaccine.

TABLE II.—EXTRACT FROM THE ANNUAL REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA FOR 1916.

The following Table shows an analysis of 191 admissions to hospital for enterica, where the actual dates of inoculation and nature of the vaccine can be determined sufficiently accurately to be of statistical value :—

Disease	Total number of cases	Not inoculated	Over 1½ years since inoculation	Under 1½ years and over 1 year since inoculation	Under 1 year and over 6 months since inoculation	Under 6 months and over 3 months since inoculation	Under 3 months since inoculation
Enteric (*B. typhosus*) ..	90	10	33	21	13	9	4
Para "A"	94	5	34	26	11	10	10
Para "B"	7	0	3	3	1	0	0
Total ..	191	15	70	50	25	19	14
Deaths.							
Enteric (*B. typhosus*) ..	22	4	5	7	2	2	2
Para "A"	3	—	2	—	—	1	—
Para "B"	0	—	0	—	0	0	0
Total ..	25	4	7	7	2	3	2

(2) RESIDUAL INOCULATION AGGLUTININS.

In Medical Research Council Special Report Series, No. 51 (p. 105), the effect produced by inoculation with triple vaccine is discussed. The following paragraph is extracted :—

"The effect of this vaccine is to evoke, in the serum of the inoculated person, agglutinins against the three bacilli employed, *B. typhosus* and *B. paratyphosus* A and B, the titre for typhoid being the highest and that for paratyphoid A the lowest, since the three organisms are not equal in agglutinogenic power."

An attempt has been made to ascertain to what extent this is borne out by experience in India. Records have been collected indiscriminately of 427 cases of typhoid, paratyphoid A, paratyphoid B, and enteric group cases. The only criterion for selection being that Widal tests should have been carried out on or before the 7th day after the onset of the disease.

All cases have been discarded in which it was considered that the period between the onset of the disease and of the patient's reporting sick had been under-estimated by the medical officer. Two additional days were added in such cases to the estimate of the medical officer, and unless the first test then fell within the 7th day period it was discarded.

It is considered that the majority of these 427 cases would exhibit an agglutinin content unaffected by infection to any great extent. Any effect on the inoculation agglutinins due to infection which may have occurred

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in a minority of the cases, would be in the nature of a rise rather than a fall, and this can be taken into consideration when amending the results.

The cases were placed in groups in relation to the period after inoculation at which they occurred, so that if possible some information might be obtained both as to the response to inoculation as regards the production of agglutinins, and the maintenance of the agglutinin content over a period of twelve months. It was found impossible to contrast the effect on the inoculation agglutinins of the 1-c.c., dose, and the ½ and 1-c.c., doses respectively, owing to the small number of the latter group of cases in each period. The percentage of one-dose and two-dose cases is therefore shown in Table III for each group.

TABLE III.—WIDAL TESTS UP TO AND FOR THE 7TH DAY.

Total cases 427 { 1-c.c. dose cases .. 309 ; ½ & 1-c.c. dose cases .. 118

Average Agglutinin Content in Standard Agglutinin Units as Result of Inoculation.

Period elapsed between last inoculation and date of onset of disease	Total cases	One-dose inoculations	Two-dose inoculations	Average inoculation agglutinins					
				T.		A.		B.	
				S.A. units	Titre of serum	S.A. units	Titre of serum	S.A. units	Titre of serum
		Per cent.	Per cent.						
Under 30 days	30	86·6	13·3	49·8	348·6	64·5	290·25	118·8	594·0
31-60 ,,	42	78·5	21·4	47·3	331·1	62·6	281·70	173·2	866·0
61-90 ,,	31	87·0	12·9	30·0	210·0	23·5	105·75	64·4	322·0
91-120 ,,	30	76 6	23·3	35·2	226·4	53·1	238·95	59·7	298·5
121-150 ,,	31	77·4	22·5	42·6	298·2	86·4	388·80	111·9	559·5
151-180 ,,	37	72·9	27·0	66·6	466·2	36·9	202·05	96·0	480·0
181-210 ,,	41	75·6	24·3	40·7	284·9	57·0	256·5	60·0	300·0
211-240 ,,	31	80·6	19·3	18·8	131·6	36·9	166·05	56·9	284·5
241-270 ,,	21	66·6	33·3	60·8	425·6	39·7	178·65	42·4	212·0
271-300 ,,	32	59·3	40·6	21 9	153·3	40·9	184·05	70·3	351·5
301-330 ,,	22	77·7	22·7	36·1	252·7	33·0	148·5	138·3	691·5
331-360 ,,	15	80 8	20·0	66·5	465·5	25·2	113·4	44·1	220·5
361-390 ,,	22	63·6	36·3	35·7	249·9	43·0	193·5	56·4	282·0

In Table III the average inoculation standard agglutinin units for the various groups is given. It will be seen that in contrast to the statement in Medical Research Council Special Report Series, No. 51, quoted above, standard agglutinin units to *B. paratyphosus* B are highest, *B. paratyphosus* A agglutinins occupy an intermediate position, and *B. typhosus* the lowest.

The average factors for the emulsions used, however, vary, i.e., 7 for *B. typhosus*, 4·5 for *B. paratyphosus* A, and 5 for *B. paratyphosus* B. If the average standard agglutinin units are multiplied by the factor of the emulsion, the average titre of the patients' sera for the different groups is obtained. The *B. paratyphosus* B element of the vaccine again appears to produce the highest response, while *B. typhosus* becomes intermediate in position, except in a few instances, and *B. paratyphosus* A occupies the lowest place.

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It is probable, however, that the inoculation agglutinins have been influenced to a certain extent by infection, and a few individuals also in each group give much higher results than the majority, therefore little reliance can be placed on an average obtained from the figures, except from a general aspect.

It was considered that a better indication of the results of the various elements used in inoculation would be obtained by ascertaining what percentage in each group gives no agglutinin units to T.A.B., and what percentage gives such low titres as five or less agglutinin units. The first of the two percentages being probably the more significant, owing to the factor for the emulsions used not being involved.

TABLE IV.—WIDAL TESTS UP TO AND FOR THE 7TH DAY.

Total cases 427 { 1-c.c. dose cases .. 309 ; ½ & 1-c.c. dose cases .. 118

Percentage of Cases showing Nil, or Five or Less Standard Agglutinin Units as Result of Inoculation.

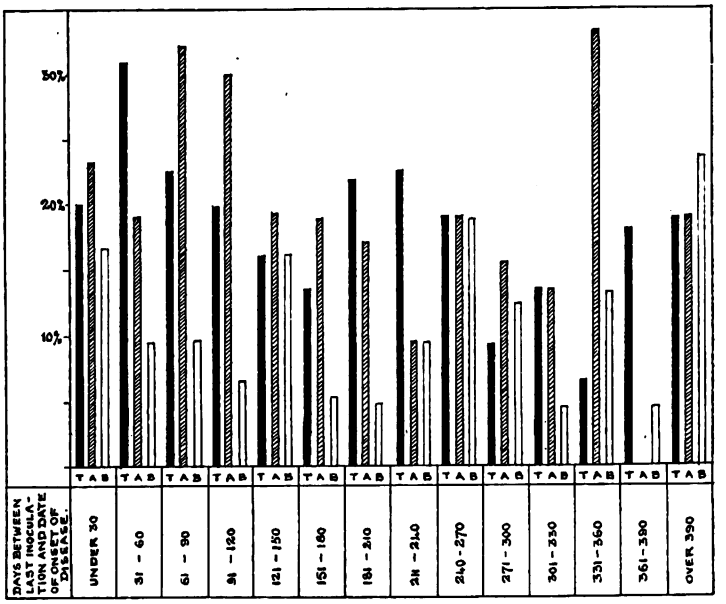
Period elapsed between last inoculation and date of onset of disease	Total cases	One-dose inoculations	Two-dose inoculations	Percentage with *nil* standard agglutinin units			Percentage with five or less standard agglutinin units (including *nil* agglutinins)		
				T.	A.	B.	T.	A.	B.
		Per cent	Per cent						
Under 30 days	30	86·6	13·3	20·0	23·3	16·6	33·3	26·6	20·0
31-60 ,,	42	78·5	21·4	30·9	19·0	9·5	40·4	23·8	11·9
61-90 ,,	31	87·0	12·9	22·5	32·1	9·6	35·4	35·4	12·8
91-120 ,,	30	76·6	23·3	19·9	30·0	6·6	19·9	36·6	13·3
121-150 ,,	31	77·4	22·5	16·0	19·3	16·1	38·6	28·9	16·1
151-180 ,,	37	72·9	27·0	13·5	18·9	5·4	35·1	18·9	5·4
181-210 ,,	41	75·6	24·3	21·9	17·0	4·8	36·5	19·4	9·7
211-240 ,,	31	80·6	19·3	22·5	9·6	9·6	32·2	16·0	16·1
241-270 ,,	21	66·6	33·3	19·0	19·0	18·9	23·7	33·2	18·9
271-300 ,,	32	59·3	40·6	9·3	15·5	12·4	31·1	21·8	25·0
301-330 ,,	22	77·7	22·7	13·6	13·5	4·5	22·6	22·6	13·5
331 360 ,,	15	80·0	20·0	6·6	33·3	13·2	13·3	46·6	19·9
361-390 ,,	22	63·6	36·3	18·0	—	4·5	27·1	18·1	13·5
After 390 ,,	42	40·4	59·5	18·9	19·0	23·7	26·1	19·0	28·5

Table IV indicates the result of this examination in figures, but the corresponding histograms illustrate the results in a more striking manner.

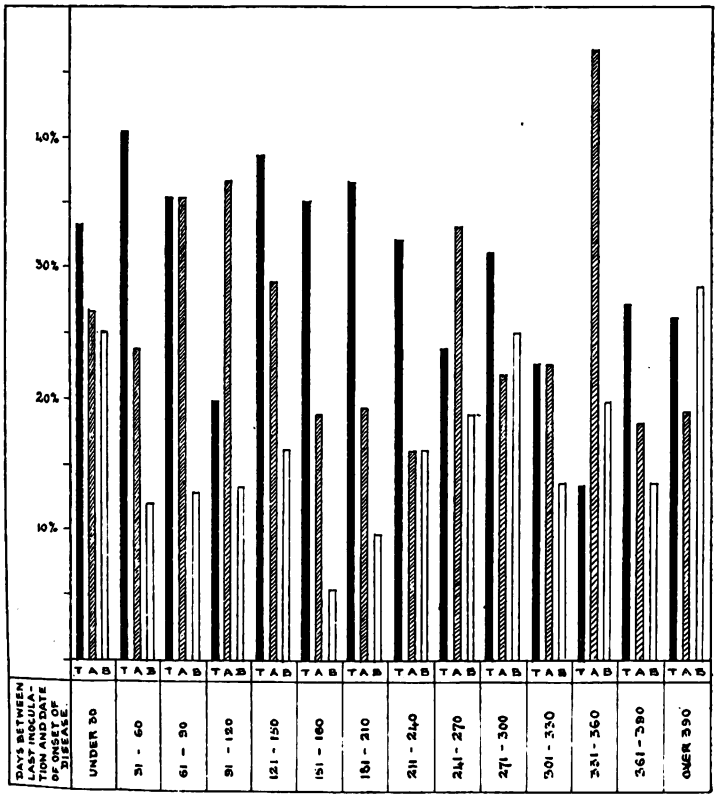
The percentages of recently inoculated cases with no agglutinin units to *B. typhosus* is surprisingly high, and it is tempting to associate these findings with the high percentage of cases of typhoid shown to occur shortly after inoculation in those cases re-inoculated with the 1-c.c. dose. The rise in the typhoid percentages showing no units in the period between the 31st and 60th day corresponds closely with the rise in incidence among the 1-c.c. inoculated typhoid cases, as shown in the graphs relating to the latter. After the sudden rise in the second month, there is a significant steady drop in the percentage of cases showing no agglutinin units to *B. typhosus* to the end of the sixth month. The secondary rise and fall

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WIDAL TESTS UP TO AND FOR THE SEVENTH DAY—TOTAL CASES, 427.
AGGLUTININ CONTENT AS RESULT OF INOCULATION.
PERCENTAGE WITH NO STANDARD AGGLUTININ UNITS.



PERCENTAGE WITH 5 OR LESS STANDARD AGGLUTININ UNITS.
(INCLUDING NO AGGLUTININS)



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after the 180th day seems difficult to explain, particularly as regards the latter. One would have expected the percentage showing no agglutinin units to be low in the first few months after inoculation and to gradually rise, but as in the time incidence of typhoid, etc., shown in the histograms of 1-c.c. re-inoculated cases in the previous section, the reverse is seen. As will be seen in Tables III and IV, most of the cases in each group showing no agglutinin units up to 360 days are re-inoculations with the 1-c.c. dose. Within the period 301 to 330 days and 331 to 360 days the percentages showing no agglutinins to *B. typhosus* are 13·6 per cent and 6·6 per cent respectively. British soldiers and Indian sepoys are re-inoculated annually with a 1-c.c. dose, and apparently the percentage of cases showing no agglutinin units to *B. typhosus* rises at once to 20 to 30 per cent, and takes some considerable time to drop again.

It is difficult to believe that the large 1-c.c. dose employed is not responsible both for the high percentage showing no agglutinins in the early months after re-inoculation, and also for the high incidence of cases shortly after re-inoculation.

The percentages showing no agglutinin units to *B. paratyphosus* A closely follow the sequence of events seen to occur with *B. typhosus*, except that the rise occurs later than with *B. typhosus*. The great rise between the 330th to 360th day is probably accidental and of no particular significance, as between the 360th and 390th day after inoculation no cases occurred out of a total of 22 giving no agglutinins.

The histogram bears out very markedly the fact also shown by the average agglutinins for each group, viz., that the "B" element of the vaccine appears to produce the strongest agglutinin response.

The histogram giving the percentages of cases with low agglutinin content (five agglutinin units or less) is of a similar nature to that discussed above, but the factors of the emulsions used have to be taken into consideration again, as in the table giving the average agglutinins, and probably account to a considerable extent for the high percentage of cases showing a low agglutinin content to *B. typhosus*.

The examination appears to indicate, therefore, that of 427 cases influenced to a small extent only by infection, and in which the great majority have been re-inoculated with a 1-c.c. dose, the higher percentage of cases showing no agglutinin units occurs in the early months after re-inoculation. These percentages closely follow the incidence of infection after re-inoculation, as shown in the previous section, and it seems probable that the negative phase after inoculation, particularly with a large dose, is to be seriously reckoned with, and that its danger instead of being over-estimated has been under-estimated in the past. Finally, the "B" element of the vaccine appears to produce the highest response, and paratyphoid A the smallest, as regards agglutinin production after inoculation.

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(3) Blood-Culture.

Blood-cultures from suspected enteric fever cases are taken almost invariably in sterile ox bile, though certain laboratories use taurocholate medium in lieu. The regulations are fairly definite on the subject, and should ensure a blood-culture being taken from all pyrexia cases of doubtful origin by the latest on the third day of the patient's admission to hospital. That a large percentage are taken at later periods will be seen by a glance at Appendix V, which shows the various days after admission to hospital on which positive results were obtained for the years 1927 and 1928.

Difficulties arise in ascertaining in what percentage of enteric fever cases positive results have been obtained, owing to the fact that a certain percentage of cases ultimately diagnosed as enteric group on clinical grounds may be due to other infections, as occurred in France before trench fever became generally recognized. In addition, certain mild cases with few symptoms, without rising agglutinins to "T," "A," or "B," and without bacteriological proof are undoubtedly diagnosed under other headings than enteric group. Presumably, if this occurs in India under peace conditions, it also occurred during the war in France. Any percentage of positive results as applied to some hundreds of cases diagnosed over a large area and in different hospitals cannot be considered therefore as very accurate.

As the result of experience in France, it was considered that the chances of obtaining positive results from inoculated cases was much less than among the uninoculated. Ledingham, however, from his experience in Mesopotamia, considered that there was no evidence in support of such a view, and it may be said that practical experience in India seems to support the opinion of Ledingham.

By far the larger number of positive diagnoses of enteric fever cases in India are obtained by means of blood-culture.

Of 93 cases of typhoid fever (bacteriologically proven) among inoculated British troops in 1927 and 1928, 74, or 79·5 per cent, were diagnosed on blood-culture results. During the same period 231 cases of enteric group infection were diagnosed, of which, on the Widal results, at least 29 per cent would be typhoid infections. The positive results of the total would therefore be under 50 per cent on the average. It is to be noted, however, that the percentage of contaminated cultures received in laboratories is between 20 to 30 per cent. A further point is that, of the 74 positive cultures, 24, or 32·3 per cent, were obtained from blood-cultures taken during the second week of illness, and 45·5 per cent after the 7th day from the onset of the disease. If all blood-cultures had been taken in the first week, and contaminations avoided, it is considered that positive results would be obtained in 70 to 80 per cent of cases at least.

This can be proved by the results of certain laboratories. In 1926, Major R. E. U. Newman isolated *B. typhosus* from the blood of 17 out of 22 cases of typhoid fever, which occurred in epidemic form in a British regiment, actually 77·2 per cent positive results by blood-culture.

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All these cases had been inoculated, and 19 of the 22 inoculated quite recently. Major C. D. M. Buckley, two years later in a second small outbreak of typhoid fever in the same regiment, reported positive blood-cultures in 10 out of 15 cases (66·6 per cent).

Major L. Walker reported 56·5 per cent positive results for a period of twelve months, and stated that 30·1 per cent of cultures received in the laboratory were contaminated.

Of a total of 234 typhoid cases among inoculated Indian troops in 1927 and 1928, the diagnosis in 180 cases (76·9 per cent) was by means of blood-culture. 251 cases of enteric group infections were also diagnosed in this period. The remarks regarding the high percentage of contaminations apply with even greater force than in the case of British troops. 33 or 18·1 per cent of the positive results were obtained from cultures taken during the second week of the illness, and 41·5 per cent after the 7th day.

The high percentages of positive results obtained after the 7th day are shown in detail in Appendix V. It should be stated, however, that four positive results included in the British troops figures, and three among the Indian troops figures, were obtained during a relapse. The positive results obtained after the 14th day, as apart from relapses, were invariably from severe cases.

An important point is that, in the experience of almost all workers in the district laboratories, it has been found necessary to incubate the ox bile medium for at least ten days before a negative result can be accepted. Many instances have been brought to notice in which the first intimation of the presence of *B. typhosus* in the culture has been the result of the plating out on the tenth day of incubation. In one case colonies were not obtained until the fourteenth day of incubation. It is possible that this inhibition phenomenon may be due to substances in the blood induced by previous inoculation.

The number of cases in which two or even three blood-cultures were taken from the same case, and in which the first was sterile and the second positive, is also surprisingly high. It is considered that if two blood-cultures were taken at an interval of a day or two during the first week of the illness in cases of typhoid fever, and contaminations avoided, positive results would be obtained in 80 per cent of cases, or even in a higher percentage in inoculated individuals.

It is impossible to ascertain accurately the figures regarding the percentage of cases in which *B. paratyphosus* A and B have been obtained by blood-culture for the reasons given above regarding typhoid infections, and there are no figures relating to the laboratory investigation of small epidemics of these diseases, as there are in the case of typhoid, to act as a guide as to probable results.

Of 34 cases (British) and 51 cases (Indian) of paratyphoid A infection in 1926, 1927 and 1928, 34 (52·9 per cent) and 28 (54·9 per cent) respectively were diagnosed on blood-culture results.

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Of 19 cases (British) and 21 cases (Indian) of paratyphoid B infection, 8 (42·1 per cent) and 10 (47·6 per cent) respectively were diagnosed on blood-culture results.

Summary.

(1) An analysis of the results of Widal tests (employing Dreyer's technique with formalized H emulsions) of 522 cases of enteric infections in T.A.B. inoculated individuals has been carried out.

(2) The results indicate that a definite diagnosis of typhoid, paratyphoid A, paratyphoid B may be arrived at in a percentage varying from 75 per cent in severe cases to as low a figure as 35·5 per cent in very mild or abortive cases. The percentage positive diminishes steadily as severe, mild and very mild cases are examined.

(3) Tables have been prepared illustrating the degree of the rise in both inoculation and infection agglutinins, and also the percentages in which a synchronous rise in inoculation units is found to occur as the result of infection.

(4) The nature of the agglutinin curves has been studied to ascertain in what degree they correspond with the usual teaching. In a large minority it is found that they differ in many important respects.

(5) Evidence is brought forward that inoculation agglutinins are stimulated to rise to a much higher percentage in cases of enteric infection than among cases of non-enteric pyrexia. Such stimulation cannot therefore be considered as definitely non-specific in nature.

(6) Although a definite classification such as typhoid, paratyphoid A or B may not be possible in percentages of cases varying according to the severity of the illness, a diagnosis of "enteric group" is possible, using Dreyer's macroscopic method in the great majority of cases of average severity. It is possible that in the very mild and abortive cases in which this method fails in a high percentage, the employment of alcoholized O emulsions may enable a diagnosis of enteric group to be obtained. It appears yet to be proved that such will be the case.

(7) Evidence obtained from a comparison of the periods of time at which infection ensued after inoculation among cases inoculated with 1-c.c. and a ½ and 1-c.c. T.A.B. vaccine appears to indicate that the former dose induces a definite negative phase, and a possible reduction in an already existing protection in a certain percentage of re-inoculated cases, particularly among British troops.

(8) The percentage of cases showing "no agglutinin units" is higher within the first few months after re-inoculation than at a later period. As the greater percentage of cases examined were those re-inoculated with a 1-c.c. dose T.A.B., it appears probable that this condition is connected also in some way with a negative phase as the result of the large dose employed for re-inoculation.

(9) From an analysis of the inoculation agglutinins of 427 cases, it appears that the vaccine employed stimulates the formation of para-

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typhoid B agglutinins in the greatest, and paratyphoid A agglutinins in the lowest degree. This finding is contrary to that of the Committee upon pathological methods, as expressed in Medical Research Council Special Report Series, No. 51.

(10) Evidence is put forward that if blood-cultures are taken with proper precautions as regards technique, period of illness, etc., practically as good results may be expected from T.A.B. inoculated cases as from uninoculated cases. Attention is directed to the necessity for prolonged incubation before accepting a culture as negative, and the utility of taking two or more blood cultures in the early stage of the disease in lieu of the usual one.

In conclusion, it is pointed out that the task of the writer has been largely that of collecting and analysing official reports from the military laboratories in India. Thanks are due to those already overburdened pathologists who have made time available to carry out Widal tests on cases already diagnosed on bacteriological grounds, and also for the readiness with which all have answered numerous queries regarding the individual cases commented on in this paper. As regards the actual laboratory technique employed in carrying out the tests, the writer has no qualms. Any misgivings are with regard to his own efforts in giving a faithful account of the laboratory results. Every endeavour has been made to be accurate, and that the conclusions arrived at should be based on facts as far as possible, and not on generalizations only.

I have also to thank Mr. G. A. Davis for the trouble he has taken in preparing the various graphs and histograms illustrating the inoculation effect, etc., on the incidence of infection, production of agglutinins, etc. Finally, I have to thank Lieutenant-Colonel H. H. A. Emerson, D.S.O., Director of Hygiene and Pathology in India, and Major-General Sir Walter H. Ogilvie, K.B.E., C.B., C.M.G., Director of Medical Services in India, for the facilities given me for the study of official records, and for permission to publish the results of the analysis.

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APPENDIX I.

Analysis of Widal Tests of 152 Bacteriologically Proven Typhoid Cases.

(*a*) Effect of Typhoid Infection on "T" Agglutinins.

97 *Cases classifiable as Typhoid.*

Severe Cases (63).

55·5 per cent over 1,000 per cent. rise (in many cases many thousand per cent)
19·0 per cent over 500 per cent rise, but under 1,000 per cent
7·9 per cent over 300 per cent rise, but under 500 per cent
17·4 per cent under 300 per cent

Mild Cases (34).

37·5 per cent over 1,000 per cent rise (only 2 much over)
6·2 per cent over 500 per cent rise, but under 1,000 per cent
15·6 per cent over 300 per cent rise, but under 500 per cent
40·6 per cent under 300 per cent rise

55 *Cases unclassifiable as Typhoid.*

Severe Cases (19).

In 19 out of 21, or 90·4 per cent there was a rise in "T" agglutinins.

15·7 per cent over 1,000 per cent rise
5·2 per cent over 300 per cent rise, but under 500 per cent
78·9 per cent under 300 per cent rise
{68·4 per cent under 200 per cent rise}
{31·8 per cent under 100 per cent rise}

Mild Cases (18).

In 18 out of 34, or 52·9 per cent there was a rise in "T" agglutinins.

11·1 per cent over 1,000 per cent rise
11·1 per cent over 300 per cent rise, but under 500 per cent
77·7 per cent under 300 per cent rise
{72·2 per cent under 200 per cent rise}
{38·8 per cent under 100 per cent rise}

(*b*) Effect of Typhoid Infection on "A" Agglutinins.

Classifiable.

Severe Cases (63).

In 19 or 30·1 per cent rise in "A" agglutinins.

2 cases over 1,000 per cent rise
2 cases over 500 per cent rise, but under 1,000 per cent
1 case over 300 per cent rise, but under 500 per cent
2 cases over 200 per cent rise, but under 300 per cent
4 cases over 100 per cent rise, but under 200 per cent
8 cases trace rise only, i.e., under 100 per cent

Unclassifiable.

Severe Cases (21).

In 13 or 61·8 per cent rise in "A" agglutinins.

4 cases over 1,000 per cent rise
2 cases over 500 per cent rise, but under 1,000 per cent
2 cases over 200 per cent rise, but under 300 per cent
2 cases over 100 per cent rise, but under 200 per cent
3 cases trace rise only, i.e., under 100 per cent

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Classifiable.

Mild Cases (34).

In 11 or 32·3 per cent rise in "A" agglutinins.

1 case over 500 per cent rise, but under 1,000 per cent
2 cases over 200 per cent rise, but under 300 per cent
2 cases over 100 per cent rise, but under 200 per cent
6 cases trace rise only, i.e., under 100 per cent

Unclassifiable,

Mild Cases (34).

In 17 or 50 per cent rise in "A" agglutinins.

3 cases over 1,000 per cent rise
1 case over 500 per cent rise, but under 1,000 per cent
1 case over 300 per cent rise, but under 500 per cent
2 cases over 200 per cent rise, but under 300 per cent
6 cases over 100 per cent rise, but under 200 per cent
4 cases trace rise only, i.e., under 100 per cent

(*c*) Effect of Typhoid Infection on "B" Agglutinins.

Classifiable.

Severe Cases (63).

In 31 or 49·2 per cent rise in "B" agglutinins.

2 cases over 1,000 per cent rise
2 cases over 500 per cent rise, but under 1,000 per cent
5 cases over 300 per cent rise, but under 500 per cent
3 cases over 200 per cent rise, but under 300 per cent
5 cases over 100 per cent rise, but under 200 per cent
14 cases trace rise only, i.e., under 100 per cent

Mild Cases (34).

In 18 or 52·9 per cent rise in "B" agglutinins.

1 case over 500 per cent rise but under 1,000 per cent
1 case over 300 per cent rise, but under 500 per cent
8 cases over 100 per cent rise, but under 200 per cent
8 cases trace rise only, i.e., under 100 per cent

Unclassifiable.

Severe Cases (21).

In 15 or 71·4 per cent rise in "B" agglutinins.

4 cases over 1,000 per cent rise
1 case over 500 per cent rise, but under 1,000 per cent
2 cases over 200 per cent rise, but under 300 per cent
4 cases over 100 per cent rise, but under 200 per cent
4 cases trace rise only, i.e., under 100 per cent

Mild Cases (34).

In 27 or 79·4 per cent rise in "B" agglutinins.

5 cases over 1,000 per cent rise
2 cases over 300 per cent rise, but under 500 per cent
4 cases over 200 per cent rise, but under 300 per cent
10 cases over 100 per cent rise, but under 200 per cent
6 cases trace rise only, i.e., under 100 per cent

APPENDIX II.

Analysis of Widal Tests of 51 Bacteriologically Proven Paratyphoid A Cases.

(*a*) Effect of Paratyphoid A Infection on "A" Agglutinins.

32 *Cases classified as Paratyphoid A.*

46·8 per cent over 1,000 per cent rise
12·5 per cent over 500 per cent rise, but under 1,000 per cent
9·3 per cent over 300 per cent rise, but under 500 per cent
31·2 per cent under 300 per cent

19 *Cases unclassifiable as Paratyphoid A.*

10·5 per cent over 500 per cent rise, but under 1,000 per cent
5·2 per cent over 300 per cent rise, but under 500 per cent
36·8 per cent under 300 per cent rise
47·3 per cent *nil* rise to "A"

(*b*) Effect of Paratyphoid A Infection on "T" Agglutinins.

Classifiable.

In 13 or 40·6 per cent rise in "T" agglutinins.

5 cases over 1,000 per cent rise
1 case over 300 per cent rise, but under 500 per cent
1 case over 200 per cent rise, but under 300 per cent
6 cases trace rise only, i.e., under 100 per cent

Unclassifiable.

In 8 or 42·1 per cent rise in "T" agglutinins.

1 case over 300 per cent rise, but under 500 per cent
2 cases over 100 per cent rise, but under 200 per cent
5 cases trace rise only, i.e., under 100 per cent

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(*c*) Effect of Paratyphoid A Infection on "B" Agglutinins.

Classifiable.

In 15 or 46·8 per cent rise in "B" agglutinins.

2 cases over 1,000 per cent rise
1 case over 500 per cent rise, but under 1,000 per cent
2 cases over 300 per cent rise, but under 500 per cent
1 case over 100 per cent rise, but under 200 per cent
9 cases trace rise only, i.e., under 100 per cent

Unclassifiable.

In 10 or 52.6 per cent rise in "B" agglutinins.

1 case over 1,000 per cent rise
1 case over 500 per cent rise, but under 1,000 per cent
2 cases over 300 per cent rise, but under 500 per cent
1 case over 200 per cent rise, but under 300 per cent
2 cases over 100 per cent rise, but under 200 per cent
3 cases trace rise only, i.e., under 100 per cent

APPENDIX III.

Analysis of Widal Tests of 24 Bacteriologically Proven Paratyphoid B Cases.

Classifiable as paratyphoid B—

11 *or* 45·8 *per cent.*

Severe cases, 6 (average pyrexia 25·2 days)
Mild cases, 5 (average pyrexia 9·7 days)
Rise T.A.B. .. .. .. 3 cases
Rise T. & B. .. .. .. 5 cases
Rise A. & B. .. .. .. 2 cases
Rise B. only .. .. .. 1 case

Fluctuation in "B" agglutinins.

2 cases (severe) rise over 1,000 per cent (actually over 20,000 per cent)
2 cases (mild) rise over 500 per cent, but under 1,000 per cent
1 case (severe) rise over 300 per cent, but under 500 per cent
6 cases {3 mild / 3 severe} rise under 300 per cent

Unclassifiable as paratyphoid B—

13 *or* 54·1 *per cent.*

Severe cases 4 (average pyrexia 21·1 days)
Mild cases 9 (average pyrexia 13·8 days)
Rise T.A.B. .. .. .. 7 cases
Rise T. & B. .. .. 1 case
Rise A & B. .. .. .. 3 cases
Nil rise in B. .. .. 2 cases

Fluctuation in "B" agglutinins.

1 case (mild) rise over 1,000 per cent
1 case (severe) rise over 300 per cent, but under 500 per cent
9 cases {6 mild / 3 severe} rise under 300 per cent.
(6 of above are under 100 per cent)
2 cases *nil* rise

APPENDIX IV.

"Enteric Group" Cases—295.

Classifiable as Typhoid—86.

British Troops $\frac{29}{131}$ .. 22·1 *per cent.*

General rise to T.A.B. .. 14 or 49·3 per cent } 66·4
Rise to T. & B. .. 1 or 3·4 per cent } per
Rise to T. & A. .. 4 or 13·7 per cent } cent
Rise to T. only .. 10 or 34·0 per cent

Indian Troops $\frac{57}{164}$ .. 34·7 *per cent.*

General rise to T.A.B. .. 9 or 15·7 per cent } 57·7
Rise to T. & B. .. 18 or 31·5 per cent } per
Rise to T. & A. .. 6 or 10·5 per cent } cent
Rise to T. only .. 24 or 42·1 per cent

Percentage rises to "T." among Severe Cases (31 B. & I.).

Average pyrexia—29·7 days.

54·8 per cent over 1,000 per cent rise
9·6 per cent over 500 per cent rise, but under 100 per cent
22·5 per cent over 300 per cent rise, but under 500 per cent
12·9 per cent under 300 per cent rise

Percentage rises to "T." among Mild Cases (55 B. & I.).

Average pyrexia—15·8 days.

41·8 per cent over 1,000 per cent rise
20·0 per cent over 500 per cent rise, but under 1,000 per cent
7·2 per cent over 300 per cent rise, but under 500 per cent
30·9 under 300 per cent rise

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CLASSIFIABLE AS PARATYPHOID A—39.

British Troops $\frac{20}{131}$ .. 15·2 *per cent.*

General rise to T.A.B. ..	9 or 45·0 per cent	70·0 per cent
Rise to T. & A. ..	2 or 10·0 per cent	
Rise to A. & B. ..	3 or 15·0 per cent	
Rise to A. only ..	6 or 30·0 per cent	

Indian Troops $\frac{19}{164}$ .. 11·5 *per cent.*

General rise to T.A.B. ..	7 or 36·8 per cent	57·8 per cent
Rise to T. & A. ..	2 or 10·5 per cent	
Rise to T. & B, ..	2 or 10·5 per cent	
Rise to A. only ..	8 or 42·1 per cent	

Percentage rises to "A" among Severe Cases (12 B. & I.).

Average pyrexia—26·6 days.

66·6 per cent over 1,000 per cent rise
8·3 per cent over 500 per cent rise, but under 1,000 per cent
8·3 per cent over 300 per cent rise, but under 500 per cent
16·6 per cent under 300 per cent rise

Percentage rises to "A" among Mild Cases (27 B. & I.).

Average pyrexia—14 days.

25·9 per cent over 1,000 per cent rise
25·9 per cent over 500 per cent rise, but under 1,000 per cent
11·1 per cent over 300 per cent rise, but under 500 per cent
5·7 per cent under 300 per cent rise

CLASSIFIABLE AS PARATYPHOID B—43.

British Troops $\frac{24}{131}$ .. 18·3 *per cent.*

General rise to T.A.B. ..	14 or 58·3 per cent	91·6 per cent
Rise to T. & B. ..	3 or 12·5 per cent	
Rise to A. & B. ..	5 or 20·8 per cent	
Rise to B. only ..	2 or 8·3 per cent	

Indian Troops $\frac{19}{164}$ .. 11·5 *per cent.*

General rise to T.A.B. ..	6 or 31·5 per cent	78·7 per cent
Rise to T. & B. ..	3 or 15·7 per cent	
Rise to A. & B. ..	6 or 31·5 per cent	
Rise to B. only ..	4 or 21·0 per cent	

Percentage rises to "B" among Severe Cases (6 B. & I.).

Average pyrexia—22·1 days.

32·3 per cent over 1,000 per cent rise
50·0 per cent over 500 per cent rise, but under 1,000 per cent
16·6 per cent over 300 per cent rise, but under 500 per cent

Percentage rises to "B" among Mild Cases (37 B. & I.).

Average pyrexia—16·1 days.

27·0 per cent over 1,000 per cent rise
27·0 per cent over 500 per cent rise, but under 1,000 per cent
8·1 per cent over 300 per cent rise, but under 500 per cent
37·8 per cent under 300 per cent rise

UNCLASSIFIABLE—127.

British Troops $\frac{58}{131}$ .. 45 *per cent.*

Severe cases 10; average pyrexia 24·6 days
Mild cases.. 48; average pyrexia 15·6 days

General rise to T.A.B. ..	25 or 43·1 per cent	5·68 per cent
Rise to T. & B. ..	3 or 5·1 per cent	
Rise to T. & A. ..	0 or 0·0 per cent	
Rise to A. & B. ..	5 or 8·6 per cent	
Small rise to T...	4 or 6·8 per cent	13·6 per cent
Small rise to B...	2 or 3·4 per cent	
Small rise to A...	2 or 3·4 per cent	
Nil rise throughout ..	9	29·3 per cent
Drop from initial test ..	7	
Nil S.A. units throughou		

Indian Troops $\frac{69}{164}$ .. 42 *per cent.*

Severe cases 15; average pyrexia 24·6 days
Mild cases.. 54; average pyrexia 16·3 days

General rise to T.A.B. ..	25 or 36·2 per cent	67·8 per cent
Rise to T. & B. ..	9 or 13·0 per cent	
Rise to T. & A. ..	5 or 7·2 per cent	
Rise to A. & B. ..	8 or 11·4 per cent	
Small rise to T...	6 or 8·6 per cent	25·9 per cent
Small rise to B...	7 or 10·1 per cent	
Small rise to A...	5 or 7·2 per cent	
Nil rise from initial test	4 or 5·7 per cent	

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Maximum percentage rises to "T," "A," or "B."	*Maximum percentage rises to "T," "A," or "B."*
12·0 per cent rise 1,000 per cent or over	8·6 per cent rise 1,000 per cent or over
10·3 per cent rise 500 per cent or over, but under 1,000 per cent	2·8 per cent rise 500 per cent or over, but under 1,000 per cent
6·8 per cent rise 300 per cent or more, but under 500 per cent	15·9 per cent rise 300 per cent or over, but under 500 per cent
15·5 per cent rise 100 per cent or over, but under 300 per cent	(8·6 per cent of these, rise 300 per cent)
(10.3 per cent of these under 200 per cent)	42·0 per cent rise 100 per cent or over, but under 300 per cent
25·8 per cent trace rise only, i.e., under 100 per cent	(18.8 per cent of these, rise 100 per cent)
29·3 per cent *nil* rise	24·6 per cent trace rise only, i.e., under 100 per cent
	5·8 per cent *nil* rise

APPENDIX V.

Positive Blood-Cultures.

Typhoid Fever, 1927, 1928.

	British Troops (74).			*Indian Troops* (180).		
	Day	Cases	Percentage	Day	Cases	Percentage
1st to 7th day ..	1st	—	—	1st	—	—
	2nd	3	4·0	2nd	10	5·5
	3rd	2	2·7	3rd	28	15·5
	4th	10	13·5	4th	29	16·1
	5th	7	9·4	5th	23	12·7
	6th	8	10·8	6th	16	8·8
	7th	5	6·1	7th	17	9·2
Total ..		35	46·5		123	67·8
8th to 14th day ..	8th	10	13·5	8th	12	6·6
	9th	6	8·1	9th	6	3·3
	10th	1	1·3	10th	7	3·8
	11th	—	—	11th	2	1·1
	12th	—	—	12th	2	1·1
	13th	4	5·4	13th	2	1·1
	14th	3	4·0	14th	2	1·1
		24	32·3		33	18·1
15th to 21st day ..	15th	3	4·0	15th	2	1·1
	16th	—	—	16th	3	1·6
	17th	3	4·0 (1 R.)	17th	4	2·2
	18th	—	—	18th	2	1·1
	19th	1	1·3	19th	—	—
	20th	—	—	20th	3	1·6
	21st	1	1·3 (1 R.)	21st	—	—
		8	10·3		14	7·6
22nd to 28th day ..	22nd	2	2·7	22nd	1	0·5
	23rd	—	—	23rd	2	1·1 (R.)
	24th	—	—	24th	1	0 5
	25th	—	—	25th	—	—
	26th	1	1·3 (R.)	26th	—	—
	27th	1	1·3	27th	1	0·5
	28th	—	—	28th	—	—
		4	5·3		5	2·6

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	British Troops			*Indian Troops*		
	Day	Cases	Percentage	Day	Cases	Percentage
29th to 35th day ..	29th	1	1·3	29th	1	0·5
	30th	1	1·3 (R.)	30th	—	—
	31st	—	—	31st	—	—
	32nd	—	—	32nd	—	—
	33rd	—	—	33rd	1	0·5
	34th	—	—	34th	—	—
	35th	—	—	35th	—	—
		2	2·6		2	1·0
36th to 42nd day ..	36th	—	—	36th	2	1.1 (R.)
	37th-42nd	*Nil*		37th-42nd	*Nil*	
		—	—		2	1·1
43rd to 49th day ..		*Nil*		43rd-48th	*Nil*	
				49th	1	0·5 (R.)
		—	—		1	0·5
Over 49 days ..	63rd	1	1·3 (R.)		*Nil*	

PARATYPHOID A, 1926, 1927 AND 1928.

1st to 7th day ..	1st	—	—	1st	—	—
	2nd	—	—	2nd	1	3·5
	3rd	2	11·7	3rd	4	14·2
	4th	1	5·8	4th	7	25·0
	5th	3	17·6	5th	—	—
	6th	3	17·6	6th	6	21·4
	7th	2	11·7	7th	2	7·1
		11	64·4		20	71·2
8th to 14th day ..	8th	3	17·6	8th	1	3·5
	9th	1	5·8	9th	—	- -
	10th	—	—	10th	3	10·7
	11th	—	—	11th	2	7·1
	12th	—	—	12th	—	—
	13th	—	—	13th	—	—
	14th	—	—	14th	1	3·5
		4	23·4		7	24·8
15th to 21st day ..	15th	—	—			
	16th	—	—			
	17th	1	5·8 (R)			
	18th	—	—		*Nil*	
	19th	—	—			
	20th	—	—			
	21st	—	—			
		1	5·8			
22nd to 28th day ..	22nd	—	—			
	25rd	—	—			
	24th	—	—			
	25th	—	—		*Nil*	
	26th	—	—			
	27th	1	5·8			
	28th	—	—			
		1	5·8			

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	British Troops.			*Indian Troops.*		
	Day	Cases	Percentage	Day	Cases	Percentage
29th to 35th day ..				29th	—	—
				30th	—	—
				31st	—	—
		Nil		32nd	—	—
				33rd	—	—
				34th	—	—
				35th	1	3·5
					1	3·5
	PARATYPHOID B, 1926, 1927 AND 1928.					
1st to 7th day ..	1st	—	—	1st	1	10·0
	2nd	—	—	2nd	—	—
	3rd	—	—	3rd	1	10·0
	4th	1	12·5	4th	2	20·0
	5th	1	12·5	5th	2	20·0
	6th	—	—	6th	—	—
	7th	2	25·0	7th	—	—
		4	50·0		6	60·0
8th to 14th day ..	8th	1	12·5	8th	1	10·0
	9th	—	—	9th	1	10·0
	10th	—	—	10th	—	—
	11th	—	—	11th	—	—
	12th	—	—	12th	—	—
	13th	—	—	13th	—	—
	14th	—	—	14th	1	10·0
		1	12·5		3	30·0
15th to 21st day ..	15th	—	—	15th	—	—
	16th	1	12·5	16th	—	—
	17th	—	—	17th	—	—
	18th	1	12·5	18th	1	10·0
	19th	—	—	19th	—	—
	20th	—	—	20th	—	—
	21st	—	—	21st	—	—
		2	25·0		1	10·0
22nd to 28th day ..	22nd	—	—			
	23rd	—	—			
	24th	1	12·5			
	25th	—	—		*Nil*	
	26th	—	—			
	27th	—	—			
	28th	—	—			
		1	12·5			

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A FULL REPORT ON THE TYPHOID EPIDEMIC IN NOWSHERA, JULY AND AUGUST, 1929.

By Major H. H. BLAKE, O.B.E.,
and
Major R. W. WALKER, M.C.,
Royal Army Medical Corps.

With a Note on Bacteriological Technique,
By Major F. GRIFFIFH,
Indian Medical Service.

We are forwarding this report for publication in the Journal with some diffidence, but do so at the request of a distinguished inspecting officer, who saw the report in the rough, and for the following reasons: (1) That it is of interest; and (2) that, although minor outbreaks occur, full reports are not available for reference; (3) that we personally would have been very grateful for a "guide" to an outbreak of this description for ready reference, instead of having to dig out every source of information we could lay our hands on in the hottest of hot weather.

The epidemic was of the explosive type and confined to one unit, the 58th Field Battery, R.A., which produced twenty-two cases.

The dates of admissions and ultimate diagnosis were :—

July 5, one case, typhoid fever.
July 6, two cases, one typhoid fever, one enteric group.
July 7, one case, typhoid fever.
July 8, one case, typhoid fever.
July 9, one case, enteric group.
July 10, five cases, four typhoid, one enteric group.
July 12, two cases, one typhoid, one enteric group.
July 16, two cases, typhoid.
July 23, three cases, typhoid.
July 24, one case, typhoid fever.
July 26, one case, typhoid fever.
July 28, one case, typhoid fever.
July 29, one case, enteric group.

On clinical recognition of the fever investigations were immediately commenced to try and determine the probable cause of the outbreak.

Distribution of Cases in Barracks and Messing.—All the cases, except two, came from one bungalow which is divided into two rooms, Nos. 11 and 12. Ten cases came from room No. 11, and nine from room No. 12. One case (storekeeper) from room No. 13, and one (regimental policeman) from room 15.

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All the cases messed together in the battery dining hall. The food was good, well served and the men were well satisfied.

Water Supply.—All water used comes from cantonment supply and is piped to each bungalow, where a tap is provided. All the suspected pipes were taken up and examined, but no defect was found.

Water is drawn from the barrack-room tap into large gurrahs, two of which are placed at the end of each verandah. This arrangement was instituted as an anti-heatstroke measure in June, 1929. One gurrah is in use and the other kept filled with "pinkie." When the gurrah in use is empty it is immediately filled with "pinkie" and the other emptied of "pinkie" and filled with water from the tap. In barrack rooms each man has a one-gallon chattie which he fills himself direct from the tap. Glasses are provided in the dining hall and each man draws his water from the large gurrah outside by means of a dipper (kept in "pinkie") as required. No native servant is allowed to handle water in the dining hall.

Food.—Milk and butter are supplied by the Military Dairy throughout barracks. No other supply is allowed. As no cases had occurred in other units, milk was not suspected as the source.

Tea, custard, cakes are obtained from the canteen which supplies all barracks.

Plums and fruit salads are also obtained from the canteen and are supplied throughout barracks.

Melons appeared frequently between June 16 and July 10 as part of the daily menu of the 58th Battery. It was ascertained that part of the supply came through the victualling agent from Mardan, where there is a considerable amount of typhoid amongst the native population. The melons were said to have been treated by "pinkie" prior to cutting. This is a strongly suspected source of infection. No other unit obtained melons from Mardan.

As the unit had only recently arrived in India, most of the men were very short of money, having to pay for new clothing. Not one single patient admitted to having taken food or drink in any of the cafés outside barracks.

Battery Personnel.—The cookhouse and dining hall were taken over, in March last, complete from the 90th Field Battery amongst whom no cases of enteric group had occurred. The list of cooks and table boys with dates of inoculation and last stool test was up to date.

On June 15 a temporary dining hall sweeper was employed for one month. This man had not been tested. He was discharged on July 12, the day prior to the commencement of the investigations.

The complete personnel, including this temporary sweeper, were collected and sent to the Indian Military Hospital for exhaustive tests. All have proved to be negative.

All the barrack boys were taken over from 90th Field Battery, and had been employed for years and periodically tested.

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From the information obtained it would appear that all the cases in the 58th Field Battery, R.A., occurred amongst personnel using the dining hall, i.e., bombardiers and men. No cases occurred amongst the serjeants and senior N.C.O's., who occupy bunks in the bungalows and utilize the canteen for tea, custard, etc., all their main meals being obtained in the Serjeants' Mess.

By July 13 there was no doubt clinically as to the nature of the cases. Previous to this some doubt existed, as temperatures had been irregular.

The dining hall sweeper, Shamba, being the only new man employed, was first suspected; his excreta were tested at the Indian Military Hospital.

All medical history sheets were carefully scrutinized, and it was ascertained that no man in the battery had an entry for the enteric group.

The cookhouse of 58th Battery was closed and the rations taken over by 25th Battery and the men fed from the 25th Battery cookhouse.

The dining hall of 58th Battery was re-established in another room. All utensils, forms, tables, etc., were sterilized under medical supervision. Four new table boys (previously tested) were taken on from the contractor.

The complete personnel, i.e., 3 cooks, 4 table boys, 2 tea boys and 2 cake and custard boys, were sent to the Indian Military Hospital for admission and investigation.

Samples of water from the taps in barrack blocks were taken and sent to the laboratory for report. No organism of the enteric group was isolated.

The normal change of hill parties was allowed to take place. Arrangements were made through the A.D.H. and P., Northern Command, for the party from 58th Field Battery, proceeding to Barian, Murree Hills, to be segregated and tested. The party left on August 2. No cases developed amongst this party.

After the visit of the A.D.H. and P., Northern Command, a search for missed cases was undertaken and a scrutiny was made of the sick reports between dates June 20 and July 4. The excreta of all men who had reported sick between these dates were examined, and blood was also taken for Widal test and culture. All examinations proved negative.

Later, blood and stool tests of the remaining personnel of the battery were made, but no carrier was detected.

One very interesting fact appeared, and that was that Gunner Berry had reported sick with diarrhœa on June 29/30. Now this particular man developed typhoid fever on July 6, and he was the only case from which the *B. typhosus* was isolated from the stools. It was thought possible that Gunner Berry might have infected the dining hall water supply.

The following was the sequence of events:—

From June 20 onwards infection of the battery took place.

Gunner Berry reported sick for diarrhœa June 29/30 in barracks.

On July 5 the first case was admitted to hospital.

On July 10 the last issue of melons in menu was made.

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On July 13 typhoid fever was recognized from clinical signs, and investigations were commenced from this date and the battery cookhouse closed.

On July 29 the last case occurred.

The infection ceased before July 21.

It is to be noted that: (i) Water supply and arrangements remained constant; (ii) milk, butter, rations and fruit supply were the same in all batteries of the brigade, except the supply of melons to 58th, appearing in menu from June 16 to July 10; (iii) flies were absent throughout the epidemic.

The carrier investigation was pursued very thoroughly. Even the families of the immediate food hawkers were visited, but no illness was detected.

As possible sources of infection the cantonment supply of water, milk and butter, and carriers, can be ruled out.

Suspicion rests on Gunner Berry and the supply of melons.

Gunner Berry, during period June 29/30, and possibly a day or so earlier, might have infected the dining hall water supply, thus causing the explosive epidemic of July 10 onwards. He had never been inoculated.

The melons were obtained from an infected source, and may have infected Gunner Berry and the first few cases.

Notes on Cases.

Of the 22 cases, 15 men were fresh to the country, having arrived from England in March, 1920. The remaining 7 had been stationed in Jubbulpore, and had average service in India of three years. It would therefore appear that length of service in India produced a certain immunity.

Strength of battery in July: 49 from England and 59 from Jubbulpore.

The severity of the cases varied enormously. The majority of the cases were mild, but some were markedly severe and all the severe cases were young soldiers. The earlier cases were perhaps less severe than those that came in later in the outbreak.

The duration of pyrexia varied markedly. The shortest was eight days and the longest thirty-seven. The lowest maximum temperature was 102·4° F., the highest 105° F. Relapses occurred in 8 cases and in 2 cases were mild, but in 6 cases were more severe than the original attack, and in one of these hæmorrhage produced a fatal ending.

The time which elapsed since last inoculation appeared to have little or no bearing on the duration of the pyrexia or on the maximum temperature, nor had it any obvious effect on the appearance of complications.

Of the 17 cases definitely diagnosed typhoid fever, 16 were so diagnosed from blood-culture and only 1 from the fæces. Of the undiagnosed cases the blood in 3 was sterile. At the earliest examination of the cases diagnosed by blood examination :—

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1	was	diagnosed	on	blood	taken	on	1st	day of admission
3	were	,,	,,	,,	,,	2nd	,,	,,
2	,,	,,	,,	,,	,,	3rd	,,	,,
1	was	,,	,,	,,	,,	4th	,,	,,
1	,,	,,	,,	,,	,,	14th	,,	,,
1	,,	,,	,,	,,	,,	20th	,,	,,
1	,,	,,	,,	,,	,,	24th	,,	,,
Total 10								

The relapse cases gave positive cultures:—

3	on	1st	day of	relapse	and on	10th day, 22nd day, 24th day after admission	
1	,,	3rd	,,	,,	,,	20th ,,	after admission
1	,.	4th	,,	,,	,,	,, ,,	,,
1	,,	7th	,,	,,	,,	21st ,,	,,

The value of examination of fæces and urine was not evident. Out of 17 positive cases, in only 1 case was *B. typhosus* isolated from fæces. In no case was the organism isolated from urine.

In all 112 examinations of urine and fæces from cases afterwards diagnosed by blood-culture were returned as negative.

The following complications occurred:—

Thrombosis (left femoral). One case developed on sixteenth day of fever and was treated with intravenous injections of seven cubic centimetres of sod. citrate (0·5 per cent) which produced very severe rigor and eased the acute pain in leg. The leg gradually settled down and now shows little difference in size. The patient was kept in the recumbent position for six weeks from the onset of thrombosis.

Hæmorrhages from bowel appeared in three cases.

In the first case it occurred on the sixth day of disease, in the second on the fifteenth day of disease, and in the third on the thirty-fourth day of disease during a relapse. This hæmorrhage was very violent and terminated fatally.

All these cases were treated with hæmoplastin.

Broncho-pneumonia occurred in two cases, both recovered.

The most prominent symptoms during the onset of the disease were:—

Constipation; this was a marked feature in every case, varying from two to six days prior to reporting sick.

Vertigo was marked in seventy-five per cent of the cases.

Headache was marked, especially in the occipital region with stiffness of the back.

Five cases complained of definite pain at the back of the eyes. The eyes in all were suffused, their condition resembling that seen in sandfly fever.

Bronchitis was definite in three cases.

Abdominal discomfort was complained of in one case only.

Apathy and drowsiness were very marked during the first ten days of pyrexia. Afterwards the cases rapidly improved, and it was noted that those most depressed in earlier stages were the most cheery later on.

Splenic enlargement was noted in four cases. It was ascertained that

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one of these cases had had kala-azar as a child. The spleen decreased with subsidence of fever, but was still palpable on transfer to E.F.C. depot, Kasauli.

Distension and meteorism were only noted in three cases. There was an obstinate temperature in four cases, lasting up to thirty-seven days.

Only two cases showed definite rash. The rash may have been present in other cases, but masked by prickly heat which was very prevalent, as the epidemic occurred in the middle of the hot weather.

Nuclein solution No. 1, five per cent (Parke, Davis and Co.) was given in 7 cases, 2 of broncho-pneumonia and 5 of obstinate temperature. As soon as the lung condition was definite in the two cases of broncho-pneumonia, one cubic centimetre of nuclein was given subcutaneously. Both cases showed rapid improvement in general condition and recovered. Nuclein produced a diminution in fever with steadying of the pulse.

In the five cases showing obstinate temperature running up from normal in morning to 99·4° F. to 100° F. in the evening, although the patient appeared otherwise well, nuclein had a definite effect after one injection of one cubic centimetre. In all four cases the temperature remained normal after twenty-four hours.

Hæmoplastin was given in three cases of hæmorrhage from the bowel, 7 cubic centimetres intravenously, and in two cases the bleeding stopped at once. The third case was very severe, and despite two injections terminated fatally.

Liquid paraffin proved very unsatisfactory in combating the persistent constipation. Soap-and-water wash-outs were largely used, but the following mixture gave excellent results in convalescence:—

Ext. cas. sag. liq.	♏ xj
Spt. ammon. aromat.	♏ xx
Ext. glycyrrhiza liq.	♏ xxx
Aq. chlorof.	ad ℥j

The diet was arranged according to the following chart:—

CHART.

8 A.M.	10 A.M.	12 NOON	2 P.M.	4 P.M.	6 P.M.	8 P.M.
	Diet A.—Early stages. Fluids only 5 oz. strained					
Tea.	Milk.	Beef tea and marmite.	Tea.	Milk.	Chicken tea.	Cocoa.
	Diet B.—Temperature subsiding.					
Bread and milk	Egg flip.	Beef tea, marmite, custard.	Tea.	Egg flip.	Chicken tea and jelly.	Cocoa.
	Diet C.—Temperature level one week.					
Thin bread and milk. No crust. Poached Eggs.	Milk	Beef tea and marmite. Pounded potatoes with gravy. Custard. Stewed apples.	—	Tea, bread and butter. Poached eggs.	Chicken tea, jelly and cream or port jelly.	Cocoa.

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Diet D.—Convalescence.

Porridge, Boiled or scrambled eggs.	Milk.	Beef tea, creamed and minced chicken. Mashed potatoes. Milk pudding.	—	Tea, bread and butter. Poached eggs.	Chicken tea. Boiled fish. Custard and cocoa.	Milk.

Full diet was given one week prior to transfer to Kasauli. Stout was given to all patients on diets C and D.

Twenty-one cases recovered and were sent to E.F.C. Depot, Kasauli. One case terminated fatally, following violent hæmorrhage from the bowel.

Despite the fact that the rush of cases occurred in July, that the weather was very hot and that prickly heat was very prevalent, not one single case developed anything approaching a bedsore; in fact, in no case was the skin on the buttocks broken. This speaks very highly for the care and attention of the nursing staff.

Bacteriological Notes by Major F. Griffith, I.M.S.

Blood-Culture.

The medium used was five per cent sodium taurocholate incubated for ten days with daily subculture on litmus lactose agar.

B. typhosus was recovered from sixteen cases out of twenty-two.

In thirteen cases the organism was immediately agglutinable in 1/250 with Kasauli serum (titre 1/1500).

In three cases daily broth subculture for ten to fifteen days was necessary before agglutination was obtained.

All organisms were subsequently confirmed by the Enteric Fever Laboratory, Kasauli.

Urine and Fæces Culture.

(*a*) Stools emulsified in glycerine and saline and sent to laboratory by post or special messenger. Thereafter plated on litmus lactose agar.

(*b*) Later, stools were plated locally after emulsification in peptone salt. Plates were brought to the laboratory by messenger for incubation.

The brilliant green method was not used.

With the single exception of the case of Gunner Berry, these cultures were entirely negative and in striking contrast to the comparative success of blood-culture.

It must be noted in this connection that when once a diagnosis was established by blood-culture further efforts to obtain an organism from the excreta also were not encouraged by the laboratory. The rush of work at this, the hottest time of the year, was immense, and the resources of the laboratory in media and Petri plates were stretched to capacity. The tendency was, therefore, to concentrate on obtaining a diagnosis in every case rather than a complete bacteriological examination of each. The fact remains, however, that a considerable number of cultural examinations

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were done on proved typhoid cases and that with one exception all were negative.

Serum Diagnosis (Dreyer's Technique).

(1) Cases diagnosed typhoid by culture	17
(*a*) Showing rise to one specific organism (T) ..	6
(*b*) Showing general rise to all	7
(*c*) Showing no rise	0
(*d*) Test not carried to completion	4
(2) Cases diagnosed "E" group	5
(*a*) Showing rise to one specific organism	0
(*b*) Showing general rise to all	5
(*c*) Showing no rise	0
(*d*) Test not carried to completion	0

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REVIEW OF CASES OF "EFFECTS OF HEAT" (HEAT-STROKE, ANIDROSIS AND HEAT EXHAUSTION) OCCURRING DURING THE HOT WEATHER OF 1929 AT ALLAHABAD.

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and

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Indian Medical Department.

The aim of this article is to record facts. For this reason signs, symptoms and treatment have deliberately been given small space, as this information can be found in any book on Tropical Medicine.

The period during which these cases occurred was from April 5, 1929, to July 5, 1929.

The total cases numbered twenty. They were all mild and no deaths occurred. They were as follows:—

	R.A.	Infantry	Others
Heat stroke (paralytic type)	1	—	—
Anidrosis (premonitory stage of heat stroke) ..	2	4	—
Heat exhaustion	—	11	1
Sunstroke	—	1*	—
Total ..	3	16	1

* This case occurred in April and is not included in the Meteorological Graph of the list of cases. It was purely a case of accidental sunstroke due to working at a bench in a carpenter's shop with the window slightly open. See list of cases.

Predisposing Causes.

(*a*) *Constipation.*—Whether this can be called a predisposing cause or a symptom is hard to say. It was certainly present in every case except one who was suffering from boils and under treatment including mag. sulph.

(*b*) *History of Alcohol and Smoking.*—In perusing the personal histories of these cases, it will be seen that the great majority are very heavy smokers. The history of alcohol is difficult to obtain. A questionnaire was written out and sent confidentially to each man affected asking the amount of alcohol consumed daily. Their answers were not very reliable.

(*c*) *Length of Sojourn in the Country.*—Under 1 year, 5 cases; from 1 to 2 years, 3 cases; from 2 to 5 years, 9 cases; over 5 years, 3 cases.

(*d*) *Past Illnesses.*—A review of the cases shows that 6 gave a history of malaria of recent date, 2 an unconfirmed history of malaria, 1 a history

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EFFECTS OF HEAT CASES.

Serial number	Unit	Indian service	Age Years	Dates of Admission	Dates of Discharge	Disease	Barracks conditions: Fans	Barracks conditions: Punkahs	Barracks conditions: Lower floor	Barracks conditions: Upper floor	Alcohol H=heavy M=moderate	Tobacco	Previous illnesses
1	Infantry	4 years	25	5.4.29	4.5.29	Sunstroke	Yes	No	Yes	No	Yes M	Yes	No record of any previous illness
2	Artillery	$1\frac{7}{12}$ year	22	9.5.29	3.6.29	Anidrosis	No	Yes	No	Yes	,, ,,	,,	,, ,, ,,
3	,,	2 years	21	18.5.29	26.6.29	Heat stroke	,,	,,	,,	,,	No	,,	Old injury to head (not in service)
4	Infantry	5 ,,	36	24.5.29	26.6.29	Heat exhaustion	Yes	No	,,	,,	Yes H	,,	Malaria B.T.; several attacks. Tonsillitis
5	,,	4/12 year	23	2.6.29	26.6.29	,, ,,	No	Yes	,,	,,	No	,,	No record of any previous illness
6	,,	2 years	22	7.6.29	15.6.29	Anidrosis	Yes	No	Yes	No	Yes H	,,	,, ,, ,,
7	,,	5/12 year	20	7.6.29	15.6.29	,,	,,	,,	,,	,,	No	,,	,, ,, ,,
8	,,	6 years	25	8.6.29	26.6.29	Heat exhaustion	No	Yes	No	Yes	Yes M	,,	Severe malaria—Kasauli case; also boils
9	,,	4/12 year	18	10.6.29	22.6.29	Anidrosis	,,	,,	,,	,,	No	,,	No record of any previous illness
10	,,	$4\frac{1}{2}$ years	27	12.6.29	28.6.29	Heat exhaustion	Yes	No	,,	,,	Yes M	,,	Malaria
11	Artillery	1 year	22	12.6.29	26.6.29	Anidrosis	No	Yes	,,	,,	No	,,	? Malaria. Did not report sick. No record of any previous illness
12	R.A.O.C.	$4\frac{4}{12}$ years	34	12.6.29	20.6.29	Heat exhaustion	Yes	No	,,	,,	Yes M	,,	Malaria B.T.; several attacks
13	Infantry	6/12 year	19	13 6.29	22.6.29	,, ,,	No	Yes	,,	,,	No	,,	No history of illness
14	,,	4 years	24	13.6.29	1.7.29	,, ,,	,,	,,	,,	,,	Yes M	,,	,, ,, ,,
15	,,	2 ,,	28	14.6.29	2.7.29	,, ,,	,,	,,	,,	,,	No	,,	Malaria B.T. once, 1928
16	,,	2 ,,	18	3.7.29	8.7.29	,, ,,	,,	,,	,,	,,	Yes M	,,	? History of malaria. Did not report sick. No other record
17	,,	4 ,,	25	4.7.29	10.7.29	Anidrosis	,,	,,	,,	,,	,, ,,	,,	No record of any previous illness
18	,,	8 ,,	26	5 7.29	8.7.29	Heat exhaustion	,,	,,	,,	,,	,, ,,	,,	Malaria
19	,,	5/12 year	21	5.7 29	8.7.29	,, ,,	,,	,,	,,	,,	,, ,,	,,	One admission for headache, 1929
20	Q.A.I.M.N.S	$1\frac{4}{12}$,,				,, ,,	Sisters' duty room on top floor						Boils. On night duty two weeks prior to admission

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of old injury to the head, and 2 gave a history of boils, 1 a history of severe headache.

(*e*) *Occupation.*—The men's occupation does not seem to call for any special comment except in the following cases:—

One anidrosis, occurring in a gunner working in the gun park shed. Two cases of heat exhaustion, one of these was working in the workshop at the Arsenal, while the other was cycling from the Fort to the cantonment at 11 a.m. The remaining cases were following their ordinary routine.

(*f*) *Influence of Type of Quarters.*—The marked feature in these cases, is the number of men affected who sleep in an upper room; sixteen slept in the upper barrack room, while three slept on the ground floor. The remaining case was a sister who was on duty in the hospital (her duty room was on the upper floor).

Meteorological Conditions.

There seemed a definite relation between the constant high mean temperature and cases of "effects of heat." The wet and dry bulb readings however coincided with the danger points given in all books on tropical medicine and these readings must remain our main warning.

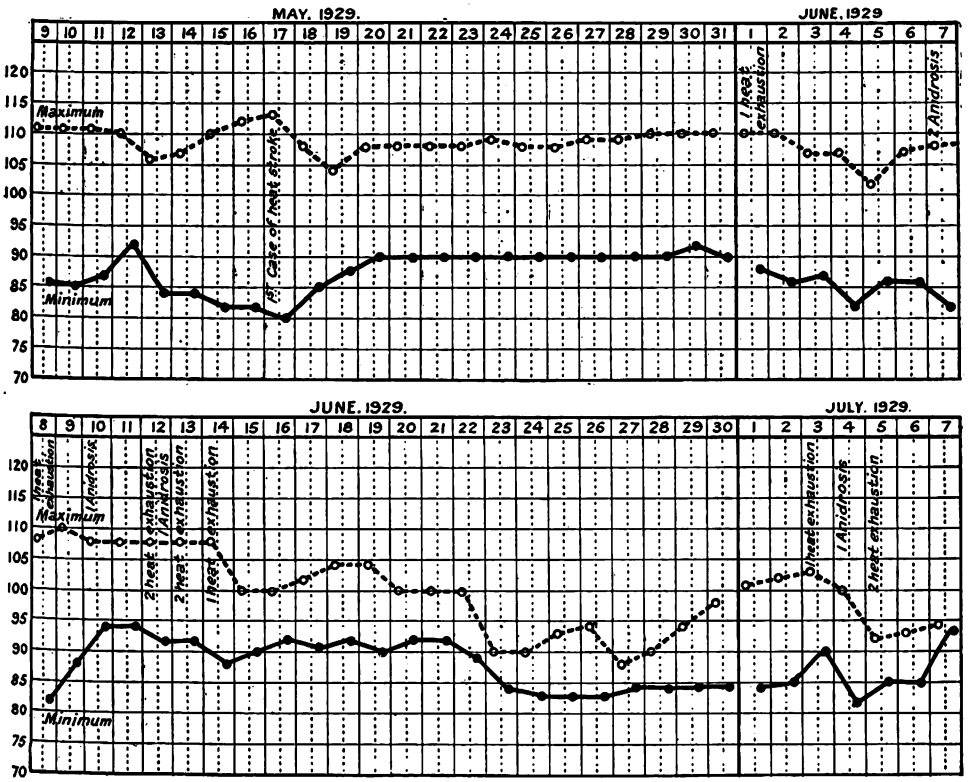
For sixteen days before the first case of heat-stroke the maximum temperature had ranged from 105° to 113° F., whereas the minimum was never below 84° F. The lowest wet bulb reading reached 66° F. for one day, and averaged 75° F., whereas the dry bulb reading had never been below 90° F.

No cases occurred when: (*a*) the wet bulb reading was below 75° F. and the dry bulb reading below 88° F.; (*b*) the lowest maximum daily temperature was below 100° F.; (*c*) the lowest minimum daily temperature was below 80° F.; the lowest mean temperature below 94° F.

It was noticed that patients in the upper wards frequently ran very high temperatures without any real cause and in addition "heat cases" were difficult to nurse owing to their proneness to hyperpyrexia. This became so apparent that all heat cases were removed to lower wards. It was thought that perhaps the louvres (wooden screens) around the verandahs were partly the cause of the great heat in the wards. To prove whether this was the case or not, an experiment was carried out as follows: The temperature readings of the verandahs around the north and south wards were taken for a week and the south ward was slightly hotter. Next the louvres from the west verandah of the south ward were removed and night readings were again taken in the verandah and compared with readings of the west verandah of the north ward. It was found that actually the south ward was hotter than the north, though the patients and staff both declared that they considered the ward much cooler after the louvres were removed. However, the temperature readings were taken for three weeks

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and proved beyond doubt that the louvres reduce the temperature slightly. (See attached chart.)



Daily maximum and minimum temperatures during May, June and July, 1929.

Clinical Signs and Symptoms.

Heat Stroke Case.—There was only one case of heat stroke (paralytic type). This patient gave a history of a head injury some years ago. His maximum temperature reached 105°F., he was unconscious for four hours; pupils, contrary to the usual teaching, remained widely dilated throughout his unconscious period, and never in fact became contracted at all. He gradually recovered after treatment by intravenous and rectal saline—the spleen was not enlarged—his blood was negative to malaria, but he was given an injection of quinine as a precautionary measure. There was no previous history of malaria in this case. He made a complete recovery.

Heat Exhaustion Cases.—These heat exhaustion cases showed a fairly definite typical course, the most notable features being the cardiac irregularity coupled with hæmic murmur, and in some cases slight cardiac dilatation. The question whether this cardiac condition is entirely secondary to the disease or a predisposing cause has to be considered, and is of great importance in routine examination of the men before the hot

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weather. The other signs and symptoms were constipation, giddiness, shortness of breath, headache, cold and clammy skin, with in some cases a history of dry skin and inability to sweat for several days, extreme lassitude and a feeling of sleepiness for days after admission; cramps were present in a number of cases varying from slight abdominal colic to actual abdominal and other muscle cramps. The temperature of these cases soon reacted, but it was noticed in many instances that a slight irregular low fever was present for a few days after the first signs of reaction.

Anidrosis Cases.—These were really heat stroke cases in the premonitory stage characterized by the following signs and symptoms: headache, dull pain behind the eyes; giddiness, severe constipation, furred tongue, inability to sweat, with a dry skin (sandy to the touch), and a very pungent odour from the mouth. They were troublesome cases, ran very irregular temperatures, in fact were always threatening heat strokes. These cases had to be nursed in a ward downstairs next to the heat-stroke room as it was found that in the upper wards they were very prone to bouts of hyperpyrexia and showed marked and rapid improvement after removal to the lower wards.

Suggestions for the prevention of "effects of heat" in Allahabad:—

(1) That the hospital upper wards be used as little as possible from May to August.

(2) That a light type of charpoy bed be furnished for troops so that a greater number can sleep out of doors (at present troops in upper barrack rooms can never sleep out owing to the difficulty in moving heavy beds). This would also enable men to sleep indoors during dust storms.

(3) The question of diets should once again be thoroughly investigated. The present diet seems quite unsuitable for the plains in the hot weather, and is without doubt a cause of constipation. Perhaps an experiment could be made by devising a diet containing a certain amount of European essentials with more vegetables, and in addition a richer supply of tropical food ingredients such as dhal, rice, atta, thus increasing vitamins.

(4) The last two hours of sleep from 4 a.m. to 6 a.m. are the most beneficial, and early rising after a hot and restless night must assuredly gradually lower one's resistance. Lack of sleep is a great cause of general lack of mental and muscular tone and therefore a predisposing cause of constipation.

It is suggested that Reveille could be arranged at a later hour from May to October than it is at present.

An issue of purgative salts twice a week. This was carried out in the battalion here for one month during the hot weather, and we feel sure acted beneficially.

Clothing.

The present type of grey-back shirt is very thick and too hot altogether.

In this connexion it is interesting to note that out of the total number of "Effects of Heat" cases, 16 British Infantry and 3 R.A. (2 anidrosis,

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1 heat stroke) the R.A. unit had not a single case of heat exhaustion, the fact that their men wore a thinner type of khaki shirt may have been the reason.

The present type of spine pad in use seems of doubtful value, it does not protect the nape of the neck unless continually readjusted; it is very thick and when the troops are on the march they invariably cross their equipment straps over it, and thus it acts as a poultice down the back and prevents evaporation; tight thick belts are worn round the waist. The puttees are very thick and the boots heavy. The sum total of this is a lack of evaporation from the body surface except for the thighs and the open neck, which is a small total body surface area.

The weight of the clothing also must be an important factor in fatigue exhaustion. We suggest lighter and looser leg wear, a stocking type puttee which is both efficient and smart, and a lighter boot. A light helmet neck shade stretching down to the level of the spine of the scapula. To please those who believe in spine pads, a thinner type of spine pad seems indicated. It is to be noted that during the entire hot weather the gunners only wore light khaki shirts while the Infantry kept to their heavy "greybacks." Could not the infantry fall in line with the gunners in this respect? We realize fully that the present type of clothing is most unlikely to be altered, but at the same time we cannot pass over clothing when writing an article on the "Effects of Heat," as clothing is after all recognized as being an important factor in the production of heat exhaustion and heat stroke.

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Editorial.

RECENT RESEARCHES ON THE VENTILATION AND HEATING OF FACTORIES, SCHOOLS AND OTHER DWELLINGS.

Until comparatively recent times the idea of ventilation was limited to the replacement of vitiated air by fresh air, and legal standards were formulated in terms of chemical purity of the air. Mainly owing to the work of Dr. Leonard Hill, temperature, humidity and especially air movement are now considered important factors. Neither the chemical purity nor the air temperature, wet or dry bulb, is an index of the physiological effects of the physical environment. Air movement must be taken into account and Dr. Hill has invented the kata-thermometer by which the cooling power of the air can be measured directly.

In 1923 the Industrial Fatigue Research Board decided to start an investigation into the physiological aspects of ventilation and the work was entrusted to Dr. Vernon and Dr. T. Bedford. They first devised a new table of air velocities based on a calibration of the kata-thermometer and made observations with the object of finding out how far the objective indications of the kata-thermometer corresponded with actual sensations of comfort. They then proceeded to make a physiological study of the ventilation and heating in certain factories and the results were published in 1926. They were in favour of natural ventilation where possible, but found that some exhaust system was necessary in certain circumstances and especially in winter when windows had to be closed. Ordinary shafts surmounted by louvres or cowls are not sufficiently powerful and are liable to cause down-draughts of cold air. They must be assisted by mechanical means. Extraction of air should never under ordinary circumstances be at floor level as it increases the draught about the feet of the workers. When extraction shafts are erected in the middle of workrooms the gratings should be only 7 ft. to 8 ft. above the floor, instead of 10 ft. The exhaust would then increase the air movement about the head of the workers. When dust and heavy vapours have to be removed there must be some extraction at floor level, but special heating arrangements should then be made to keep the feet of the workers warm.

Where natural ventilation with moderate exhaust cannot be satisfactorily employed, plenum ventilation discharging the hot air at floor level and not overhead has given good results. In factories where dusty processes are carried on, such discharge at floor level cannot be permitted, but even then the ducts may be placed a few inches above the floor and the entering air can be deflected upwards by a baffle plate. In any case the opening of the ducts should not be more than 6 inches in diameter,

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otherwise they cause objectionable draughts. Such a plenum system may give rise to a large temperature gradient, and it might be preferable to start a system of fan extraction with a heating system placed near, or under the floor. The hot-air radiators should be kept at a low temperature, otherwise the heated columns of air rise rapidly to the ceiling. Steam pipes are the worst offenders in this respect, though some overhead piping is often desirable to prevent down-draughts from skylights.

Overhead plenum installations are bad, as they may produce a difference of temperature between floor level and that at 10 feet of from 11° to 21°; they often produce great discomfort to the workers, as with a high temperature above the head there is usually a rapid fall of temperature from head level to the floor and consequent cold feet. When the heating is placed near the floor there is a low temperature gradient with a difference of temperature of only 1° to 2° between floor and head levels, when the heating is under the floor the difference is less than 1°. With natural systems of ventilation the air felt rather more fresh than in plenum systems and was more humid.

In 1928 the Industrial Fatigue Research Board issued a report by Dr. Vernon on the physiological effects of radiant heating in various buildings. In the introduction to the report, Dr. Vernon says there is a widespread belief that radiant heat from gas fires and coal fires is more pleasant and exhilarating to the human organism than heat from hot-water pipes and radiators, as these transmit heat mainly by convection currents of hot air and only in a minor degree by radiation. Plenum hot air heating yields an even smaller fraction of radiant heat and is still less in favour.

As gas fires and coal fires are not suitable for the heating of large buildings, Dr. Vernon proceeded to study the panel system of radiant heating which was patented by Barker in 1908. This system has developed greatly of recent years and has for the most part taken the form of ceiling heating, which might be considered wrong in principle, as in his previous report Dr. Vernon insisted that the source of heat should be as near the floor as possible. This conclusion is correct when applied to plenum systems, hot-water radiators, and exposed steam and hot-water pipes which set up convection currents rising to the upper parts of the room. In the panel system, however, the heat is wholly radiant; and there is practically no stratum of hot air below a ceiling panel and no convection currents form to carry away the heat. When the panel is in a wall only sixty per cent of the heat is radiant.

In offices and other buildings heated by concealed panels in the ceiling or wall, Dr. Vernon found a remarkable uniformity in the distribution of heat, the air temperature may be steady to within 1° all over the room at all levels. Owing to the radiation the walls, floor and ceiling are about 3° hotter than the air, while in rooms heated by hot-water radiators the walls, etc., are 3° cooler than the air. The most obvious merit of the panel system is the equal distribution of heat all over the room. Barker

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considered that the feeling of comfort in a room is measured less by the air temperature than by the amount and the character of the radiation, and it has been claimed by some engineers that the radiant warmth from a ceiling-heated room approximates closely to that produced by sunshine. For this claim, Dr. Vernon has been able to obtain little support. He was unable to detect the radiant heat unless close to the heated surface.

Barker also stated that radiant systems are more economical than convection systems. This is probably true of steam-heated pipes, where much of the heat is wasted in the upper layers of the room. But with low temperature radiators installed close to the floor there is a more even distribution of heat, and there is no reason to suppose that such a system is less economical than a panel system, indeed there may be less loss of heat through the walls than in a panel system.

Dr. Vernon and his co-workers thought that the panel system would be suitable for factories, but as there was at the time no factory so heated they were unable to make any direct experiments to ascertain its effect on the workpeople.

This year Dr. Vernon and Dr. Bedford have issued a report on further investigations on the panel system of heating which were designed to yield more extensive evidence of the effects of radiant heating. The actual effects produced can be ascertained only by making series of comparable observations under the various systems of heating. The influence of the systems of heating upon the surface temperature of the head, hands and feet was ascertained by means of a Moll thermopile, which is a very accurate instrument and has the advantage that the galvanometer attached to it reaches its maximum deflection in about seven seconds. The deflections were converted into temperatures by calibrations made against a lamp-black surface which was found to have the same emissivity as that of the skin.

The temperature of the mouth was also taken with a clinical thermometer and tests of manual dexterity at the different temperatures of the rooms were also made.

Sensations of air temperature and air movement were noted and for the most part ran parallel. Too warm air usually felt stagnant and too cold air usually felt fresh.

A comparison of the effects produced by under-floor heating and by stove-heating was made in the new schools recently erected by the Derbyshire County Council. In the classrooms with under-floor heating the heating is effected by 2-inch hot water pipes which are 16 inches apart and are supplied from a 3½-inch pipe which runs horizontally along one or two walls of each classroom at a height of 7¼ feet above the floor. They maintain the floor at a temperature of 63° to 76° F. One of these classrooms was used by the committee and compared with a stove-heated classroom which was heated by an anthracite stove ; direct radiation from the stove to the subject of the experiment was prevented by a screen and

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the air temperature was maintained by convection currents from the stove. The ventilation was so arranged that the dry kata cooling power was the same in the two rooms. When the cooling power was 6·5° the floor temperature of the floor-heated room was 19° F. higher than the stove-heated room, at 6 in. above the floor the air temperature was 6° warmer than in the stove-heated room, but at head level was only 1° warmer. The velocity of the air in the floor-heated room was nearly double that in the stove-heated room.

As regards the effects of the atmospheric conditions on the skin temperatures of the observers, it was noted that the forehead temperature remained steady throughout the experiment of three hours and was 1° lower in the stove-heated than in the floor-heated room. The other surface temperatures fell steadily throughout the three hours. The finger and palm temperatures in the two rooms corresponded fairly well, but the foot temperature was 5° lower in the stove-heated room. This difference was the direct effort of the warm floor.

At equal cooling powers the air in the floor-heated room felt warmer and less in motion than the air in the stove-heated room.

A comparison of effects produced by panel heating and by protected gas fire heating was then made by the same observers in another school near London. In the panel heated schoolroom the panels were exposed in the ceiling and had an average temperature of 112° F. In addition to the panels a 3½-in. hot water supply pipe ran on each side of the room just below the level of the swivel windows.

In the schoolroom heated by a gas-fire direct radiation on the subjects was prevented by the interposition of a wooden screen ; at a cooling power of 6·8° the forehead and palm temperatures were much the same in the two rooms, but in the gas-fire room the finger temperature was 4° lower and the foot temperature 4° higher than in the panel-heated room. The gas-fire room felt 1° cooler than the panel-heated room.

In previous experiments the investigators found that rooms heated by an anthracite stove and hot water radiators felt 0·7° cooler than those heated by wall panels and ceiling panels, but these panels were concealed. They conclude that the radiation from hot-water-fed panels causes an extra heating effect on the individuals subjected to it corresponding to an increase of 1° F. air temperature. In other words a slightly lower cooling power is consistent with comfort in panel-heated rooms.

These low temperature radiation systems of heating have the further advantage of inducing a very even distribution of air temperature, together with a floor temperature which is about 3° higher than the air above it.

In considering a system of ventilation attention must be paid to the manual dexterity of the individuals subjected to it. The fingers of workmen, clerks, and children must not be so cooled that they lose speed in manual work, writing, etc. By means of a chain assembling test

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performed at twenty-minute intervals the observers found that after three hours in air at a cooling power of 10·1° which felt much too cold, the hand temperature fell to 70° and there was a loss of twelve per cent in speed of performance. A repetition of the test on three boys indicated a similar loss of dexterity.

The effect of atmospheric conditions on the hand temperature of 175 children attending semi-open-air schools, panel-heated and ordinary schools, was next investigated and it was found that this temperature varied with the cooling power of the air and it was found that, at a cooling power of 14·4°, 87 per cent of the children had a hand temperature below 70°, which was considered the lowest temperature compatible with school efficiency.

Observations on the hand temperature of 115 children attending practically unheated open-air schools showed that the temperatures were 5° higher than those shown by children in artificially heated schools at equal cooling powers. This was probably due to the fact that the children in the open-air schools were specially fed, warmly clothed and only worked for short periods with alternating periods of physical exercise. By means of canvas blinds the cooling power of the air in open-air schools can be reduced to half that experienced in open-air sheds. Nevertheless the efficiency of the children in very cold weather was only half that of children in heated schools.

There is evidence to show that the health of children is influenced by the atmospheric conditions of the school which they attend and variations in health may be shown by the attendance rate of the children. Dr. Vernon and Dr. Bedford studied the attendance data from April 26 to March 29 of thirty Derbyshire schools and conclude that it is not permissible to assume that the whole of the absenteeism is due to sickness. The absenteeism (7·6 per cent) was lowest at ordinary schools with good cross ventilation and highest (10·2 per cent) at badly ventilated schools, whilst at floor-heated semi-open-air schools it was 8·4 per cent. Absenteeism is considerably influenced by temperature. At unheated open-air schools only half the children attended during a spell of very cold weather, but this was not entirely due to ill-health, but to the restraining action of the parents. In schools kept at 63·4° absenteeism was 8·9 per cent, at 58·5° it was 11·1 per cent, and 11·6 per cent in those at 55·7°.

Drs. Vernon and Bedford state that the most important question raised in their report is the substitution of open-air schools for schools of the ordinary type. They have shown that children attending open-air schools work with only half the efficiency of those in warmed schools, and require to be specially fed and clothed.

They ask, cannot the principle be applied in a less drastic manner so as to retain its advantages without its disadvantages? An answer to this question is given by the semi-open-air schools in Derbyshire. It has been shown there that if the children are to attain full efficiency in writing and drawing, and absenteeism is to be kept at the lowest possible figure, then

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the air temperature of the schools must be kept at about 60° and certainly not below 55°, and the cooling power must not exceed 8°. Drs. Vernon and Bedford state that if the under-floor system or ceiling-panel system in semi-open-air schools were increased in power the schools could be maintained at a higher temperature without diminishing the air movement consequent on open windows and doors. Probably the best system of heating would be a combination of the under-floor and ceiling-panel systems. By careful arrangements of doors and windows, the cooling power of the room should be kept as equal as possible, and the children should never sit at their work for more than an hour at a time, when there should be a ten minutes' interval for physical exercise. If the children could be provided with a good meal they would require less warmth in the school-room.

The objection of parents to sending their children to open-air schools might, to some extent, be overcome by heating the schools by the under-floor system; the feet of the children would be kept warm and the artificial heat not wasted so much as it is by other methods. Moderately heated ceiling panels would be useless, as they warm the surfaces radiated against only 1° to 3° above the surrounding air. Anthracite stoves and hot-water pipes would be of little use as they warm only the children in their immediate neighbourhood.

As regards the substitution of under-floor heating or ceiling-panel heating for the hot-water pipes and stoves now in use, Drs. Vernon and Bedford point out that compared with convection heating the under-floor system has the advantage of heating the air 2·5° and the ceiling-panel system 1°, and both cause a more uniform distribution of heat and keep the feet warmer than the head. They also do not take up valuable space and are more suitable for classrooms with glazed swing doors on two sides than hot-water pipes and radiators. The investigators prefer ceiling-heating to floor-heating for most purposes, though not for open-air schools. Neither system is perfect, and requires to be assisted by hot-water pipes under windows to prevent down-draughts.

They consider that under-floor heating is not suited for factories where the floor is much occupied by machinery, but if the floor is clear, and especially in workrooms where the doors are constantly being opened to admit material, and down-draughts are frequent, a heated floor would prove most acceptable.

The semi-open-air method would not be suitable for most industries, as dust-laden gusts of air are inevitable when the doors are opened, and would interfere with most processes.

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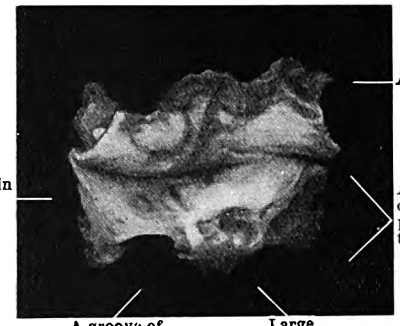
Clinical and other Notes.

A CASE OF A CYST OF THE EXTERNAL SEMILUNAR CARTILAGE.

By Major R. R. G. ATKINS, M.C.,
Royal Army Medical Corps.

As this is a rare condition, the case is of interest. When seen the patient gave no definite history of an injury. He said that about four months previously he had fallen down some steps and might have hurt his knee slightly. He reported sick with a feeling of pain on the outer side of the joint and a sense of weakness of the knee-joint.

Clinical Signs.—There was a slight degree of fluid in the joint. The tone of the vastus internus was poor and there was a good deal of wasting of the thigh muscles. Just anterior to the external lateral ligament there was a swelling the size of a large pea; this felt elastic to pressure and was fixed.



Horizontal section of cartilage. Note the striated appearance of cut surface of the cartilage.

There was tenderness over the anterior end of the external cartilage and the infrapatellar pad of fat was enlarged. The cartilage area between its anterior end and the external lateral ligament felt "boggy" to touch, but there was no œdema. A radiogram of the joint showed no abnormality.

Condition found at Operation.—The external cartilage was detached from the tibia as far back as the external lateral ligament. The anterior end was embedded in the pad of fat, which was very large and showed considerable fibrosis. The connective tissue between the cartilage and the capsule had undergone cystic degeneration; there was one large definite

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cyst, the remainder being merely a mass of tiny cysts. The cartilage was removed.

On horizontal section of the cartilage, one cyst the size of a pea was seen just anterior to the popliteus tendon; this was definitely intracartilaginous. There was another smaller cyst behind the level of the popliteus tendon, also intracartilaginous. There were several longitudinal spaces filled with a mucoid substance. The cartilage appeared to consist of bundles of fibrous tissues in irregular striations.

The specimen has been sent to the College at Millbank.

Cysts in connection with the semilunar cartilages are rare. They have been recorded by Ollerenshaw and Furnival in England and also by several continental surgeons.

The origin of these cysts is a matter of speculation. It is interesting to note that in all the cases recorded, with one exception, the external cartilage was involved.

Timbrell Fisher is of opinion that these cysts are ganglia occurring in the connective tissue between the peripheral border of the cartilage and the synovial membrane with which it is covered at this spot. He points out that these ganglia always occur in the same situation, i.e., at the place where the tendon of the popliteus muscle crosses the cartilage, and that this is the only situation where either cartilage receives a partial covering of synovial membrane in connection with its peripheral surface.

In the specimen I have described the condition noted by Timbrell Fisher is present. As well as this there are two definite intracartilaginous cysts which cannot possibly be due to the invasion of the cartilage by these connective tissue cysts. The irregular striation of fibrous tissue in this specimen is also of interest.

A microscopic section of the cartilage would be of great interest.

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A CASE OF SECONDARY OPTIC ATROPHY.

By Major J. A. BENNETT,
Royal Army Medical Corps.

The following notes may be of interest on account of the relative rarity and the nature of the lesion:—

History.—On January 28, 1930, a soldier, aged 24, was knocked out in a boxing match on a troopship. His head hit the deck and a small wound one inch long over the left eyebrow resulted. He was admitted to the troops' hospital on board and complained of blindness in the left eye.

On February 15 he disembarked and was transferred to the 7th General Hospital, Shanghai, when his condition was found to be as follows:—

Pupils equal, movements normal. Tension normal in each eye.

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Reaction to Light.—Left. No reaction of left pupil to direct light stimulus; exaggerated consensual reflex.

Right. Reacts to direct but not consensually.

Left eye has some perception of light; otherwise blind.

Ophthalmoscopic Examination.—Atrophy of the left optic nerve; disc greyish white in appearance with a small pinkish crescent at the nasal side. The edges of the disc are sharply defined and there is no retinal change round the disc. The retinal vessels are normal. Lamina cribrosa well seen.

Comments.—The lesion is in the left optic nerve. The history and present condition suggest that there might have been a fracture of the orbit involving the optic canal, probably causing an extravasation of blood between the nerve and canal, i.e., a hæmatoma of the sheath of the nerve.

The case is one of descending degeneration of the optic nerve, and as time goes on the optic disc will become quite white like a primary optic atrophy.

The man has been invalided to the United Kingdom.

A NOTE ON THE PREVALENCE OF PULMONARY AND OTHER FORMS OF TUBERCULOSIS IN LAGOS AS REVEALED BY POST-MORTEM EXAMINATION.

By Major W. J. E. BELL, D.S.O.,
Royal Army Medical Corps.

Whilst I was attached to the West African Medical Service on anti-plague duty in Lagos I had the opportunity during the year 1929 of performing a considerable number of post-mortem examinations at the public mortuary.

The primary object of these examinations was to ascertain the presence or absence of plague.

When engaged on this work I could not help being struck by the high incidence of tuberculosis, chiefly pulmonary, by the severity of the lesions and by the low standard of resistance found in the subjects, although from previous experience as Medical Officer of Health, Lagos, I knew that the disease was prevalent and possibly on the increase.

Previous statistics of this disease have, of course, been published in numerous annual medical and sanitary reports from Nigeria, but it is thought that these first-hand unofficial notes may have an interest for some readers of the Journal of the Royal Army Medical Corps as a reminder that the malady is by no means confined to these northern countries, in which it has been recognized as a scourge from time immemorial.

The examinations consisted of routine naked-eye inspection of inflamed

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or enlarged lymphatic glands and of the contents of the thoracic and abdominal cavities.

Smears were examined from buboes, spleen and lungs.

The advice of the Government Pathologist was available where diagnosis was doubtful.

Between February and November of the year in question 299 examinations were made, out of which tuberculosis was given as the cause of death in 31 cases, or 10·36 per cent; 23 cases, or 7·69 per cent, being pulmonary in character and 8 cases, or 2·67 per cent, non-pulmonary.

The seasonal distribution of the cases was as follows:—

	Feb.	Mch.	Apl.	May	June	July	Aug.	Sept.	Oct.	Nov.
Pulmonary ..	*Nil*	1	*Nil*	5	3	3	4	2	4	1
Non-pulmonary ..	*Nil*	1	2	*Nil*	*Nil*	2	1	1	1	*Nil*
Total ..	*Nil*	2	2	5	3	5	5	3	5	1

The period May to October corresponds to the so-called large and small rains.

This season of heavy rain is broken during the months of August and September by a few weeks of cold winds and drizzle, known as the *Owore*, which period is much dreaded by the native population and is always accompanied by a considerable amount of pulmonary disease.

The age at which the disease was found varied between 2 and 89 years. As the following table shows, the highest incidence occurred in the third decade of life:—

	(1-10)	(11-20)	(21-30)	(31-40)	(41-50)	(51-60)	(61-70)	(71-80)
Pulmonary	2	2	8	3	1	5	2	*Nil*
Non-pulmonary ..	2	*Nil*	2	2	*Nil*	*Nil*	1	1
Total ..	4	2	10	5	1	5	3	1

The two cases of pulmonary tuberculosis which occurred in the first decade were both males, aged 2 and 3 years respectively.

They both showed enlarged and caseous peribronchial lymph glands with widely scattered patches of caseous pneumonia on both sides.

In neither case were any lesions found in the spleen, liver or intestines.

The majority of the pulmonary cases in adults were bilateral with cavity formation, usually, but not invariably, confined to the upper lobes.

One lung would usually be completely caseated with cavity formation in the upper lobe, whilst the other would contain numerous scattered tuberculous foci and conglomerate patches of caseous pneumonia.

Practically all these cases were attended by severe pleurisy, the adhesions being often so strong that it was impossible to separate them without injuring the organ.

The rarity of healed or healing tuberculosis scars seemed to point to a low standard of resistance. In fact, in the 299 examinations which I carried out, I have only one note of a case of this kind, an elderly male who died of plague. In this instance a number of hard nodules could be

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felt scattered throughout the organs on both sides which, on section, were found to consist of masses of pigmented tuberculous scar tissue.

Pulmonary tuberculosis was found, as a cause of death, on four occasions where the age was given as 60 years or over, the eldest being in a female stated to be 65. The conditions found in the lungs of these elderly people did not differ materially from those found in subjects of less mature age.

A diagnosis of tuberculous peritonitis was made in cases in which the condition was found unaccompanied by obvious lesions in other organs or by generalized tuberculosis. It occurred in four cases, aged 2, 8, 40 and 64 years respectively. The condition was far advanced in all the cases, but especially in the two elder, with dense matted adhesions and caseated lymph glands, which rendered a more detailed examination difficult in the limited time which I had at my disposal. It was probably, in every case, secondary to infection in the intestine or elsewhere.

Two cases of general miliary tuberculosis were found, both being in the fourth decade of life. One was associated with ulcerative colitis, but it is doubtful if the latter was tuberculous in character.

In one case, an old man aged 80, the epididymes were matted together into a mass of broken-down caseous material which was discharging through a fistula in the scrotum. Both testes were also affected.

In one subject, a male aged 27, multiple abscesses and cavities which had the characteristics of a tuberculous origin were found in a cirrhotic liver.

The absence of bone and joint infection and the rarity, or possible absence, of primary intestinal infection amongst children examined in this series can be explained by the fact that fresh cow's milk does not usually form an article of their diet.

Echoes of the Past.

THE REMINISCENCES OF AN ARMY SURGEON.

By Lieutenant-Colonel W. A. MORRIS,
Royal Army Medical Corps (retired).

(*Continued from p.* 65.)

After a short leave we reported at Aldershot. We now possessed the chief emblem of commissioned rank, the sword—the weapon with which we fight and defend our country and ourselves; the companion of our official life; the sign and mark of authority; destined finally to hang in the hall of the old home, as mine does under my father's beautiful blade, worn when he was in the Gloucester Yeomanry.

The climate of Aldershot, the smartness, the work, the blast of the trumpet, the sounding bugle, the rolling drums, and the clash of arms, all

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served to brace and nerve the new arrival to a sense of his position and all yet before him. I recollect arriving from Wales, but my nerve failed me to face Mess that night, and so I was purposely late and dined at the hotel. I had a good dinner and a bottle of Château la Rose to myself, which gave me courage, and then I went to the Mess and saw my comrades, being excused dressing under the circumstances.

The next morning we were assembled at the Orderly Room and were told off in squads to learn our drill, and soon were on parade and lined up in front of Serjeant-Major Buckley, afterwards Major and Quartermaster. Buckley was a fairly tall, well-set-up Irishman, with much humour. The only defect in his appearance was his forage cap, which was slightly crooked and drooped towards his left eye. Gloved and with his swagger stick under his arm, he stood in rather a restless fashion looking straight at us, while an N.C.O. straightened us up and adjusted our uniforms prior to his inspection. Suddenly, like a report from a gun, came the word "Attention," but Buckley never said that word, he only meant it. He said, "Squad, 'shun," and at the same moment his lithesome figure became as straight as a ramrod, except for the cap; the restless muscles were stayed, and the swagger stick was braced to his side at the advance. We were all sixes and sevens after this explosion, when Buckley said, "Corporal Bond, come to the front and give the detail." At this, out came Corporal Bond, a well-covered, painstaking corporal, a very smart drill instructor, with a quiet manner, and explained the exact position of our thumbs to the front edge of the red stripe on our overalls. Good old Bond, I shall have more to say of him later, but will merely note here that he would have reached early promotion if he had passed the educational test, but this he could not do. However, he was with me later when I was Adjutant to the V.M.S.C., and I brought his good work personally to Sir William Mackinnon's notice, and he was given the rank of Hon. Serjeant-Major when serving with the Volunteers.

After Corporal Bond had again instructed us in the detail and calmed our nerves, we had another explosion of "'Shun" and having drilled better, were ordered to "Stand at ease," for which latter military movement the patient Bond was again brought to the front to teach the detail. After this the Serjeant Major blew us up with the two reports, quickly repeated. We stiffened and relaxed and the cap of one of us fell off, when suddenly out of the ranks coolly walked the delinquent, causing by his action an absolute demoralization of the exercise. Some of us politely desired to pick the cap up, and moved or lurched in its direction, and then it was pointed out that we were not standing in our own ground and had moved our right feet. From the lecture we received over this *contretemps* we felt we had almost imperilled our commissions by so gross and heinous an offence. However, we had learned something, and had been nearly scared to death, when with a quizzical smile the Serjeant-Major dismissed us.

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This drilling was very interesting and beneficial. It straightened us up and made our clothes fit well, hardened our muscles, improved our walking, and just completed our education where it was most defective. After this and for some time we were sandwiched in between soldiers who knew their drill, possibly budding instructors, and tried their patience and good temper. The order *Right turn* would send us all to the left, and the *Right about* would send us, especially the Irish contingent, right about by the left. Of course we talked and jabbered, and laughed at everything at first, but became serious as the comic aspect faded away. Sometimes in changing *Files right* or *Files left* as we were advancing, two files at the left would turn right and march off into the wilderness by themselves, till they noticed the silence and loneliness, and then their confusion was great, for discovering their position they would rush headlong back to the company and be received sarcastically by the instructor: "We're waiting

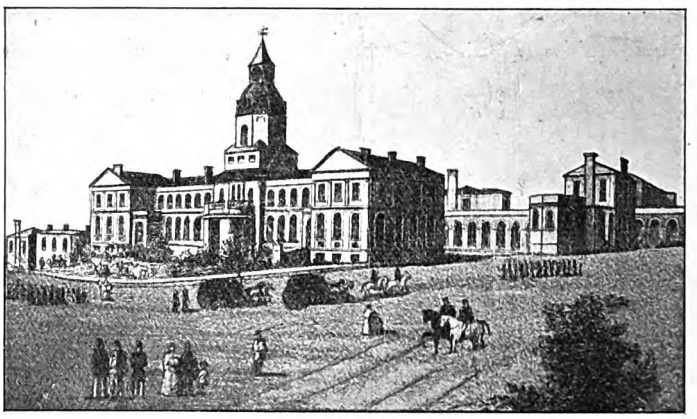


FIG. 2.—Cambridge Hospital, Aldershot.

for you, gentlemen, don't be long." It was a great consolation to me to notice that the brains of our contingent got caught this way.

I recollect on one occasion being extremely stupid on parade. I had received the order *Right turn*, and immediately turned to the left and faced the perfect drill next to me with his beaming face, over which loomed a beautiful well-greased love-lock, supported by a Partingtonian cap, held to the head by a thin strap carried over the mountains and dales of cheek and chin. My error was successful in drawing Serjeant Reynolds, who rushed up to the perfect drill and cried out, "Wot ye doing? Think ye got a 'ead, when you don't know your right 'and from your left? You ain't got a 'ead, you got a cabbage." I hope I bucked up after this if only for the sake of the good man with the curl. Another instructor of less degree was heard teaching the facings, and he remarked, "To turn to the right or to the left, you place the right or left heel in the instep of the right or left foot, making a right or left angle as the case may be."

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Not the least important of our course at Aldershot was equitation, and on three afternoons in the week we had to appear in the riding school of the 4th Hussars.

After lunch we went to our quarters, and proceeded to struggle into our long boots and don our spurs. Lying on our backs to get a good leverage, and with the liberal application of French chalk, we got those awful foot-screws on, and then walked a mile to the riding school. Some of us had had some experience of horses, but many knew nothing about them. We entered the *manège* and stood by our chargers.

"Take off your spurs, gentlemen," was the first order we received from the riding master. We then mounted, but before moving came the order "Cross your stirrups," followed by "Walk march," and we began walking in file round the school. Our tight riding breeches and the glassy and slippery surface of the saddle weakened our confidence, which became still weaker when we felt our feet being turned and twisted into all kinds of positions by the riding master's assistants. "Trot" was the next order, and away we went with our horses diving their heads into the corners of the school. As the Faculty on shaky seats were hustling round the school, the excitement and uncertainty increased. Noise and some dust were made as the beautiful horses followed the riding master but took no notice of their riders. "Trot out" roared the riding master, and we felt the huge muscles of our horses as we trotted at full speed round the course. We hung on, but were getting into fearsome positions. One of us was gallantly embracing his war-horse round the eyes, which nodded his heavily weighted head till at last he laid his rider gently in the tan. This was the first casualty, but more were to follow. Two or three more fell off as the horses swung round the *manège*, and none of us knew who would be the next to lick the dust, when suddenly a halt was called, and the horses pulled up in their stride. Where pace, tumult, and noise dominated, there was now silence. The Faculty of Medicine had tried to keep its position, but some were thrown into the tan, and some, like a drowning man clutching a straw, had seized a piece of mane or harness, and hung on tenaciously till they were laid out more easily, though in no less an undignified manner. "Thank you, gentlemen; I hope none of you are hurt, you will soon get used to it. We shall meet next Tuesday."

We rose to the occasion and quickly became used to our horses, except two or three who never would ride. We found Captain Elliot of the 4th Hussars very considerate. He was rather passionate, but never displayed his feelings beyond leaning against the boards and groaning. We could see him writhing and his jaw moving, not in prayer, but as if he were wrestling with some of the difficult foreign words he had heard in a long career abroad. Nothing drew him more than having a horse jockeyed, and Nealon from Co. Mayo knew the last word about horses, and how to ride them, and his horse knew it, for riding was mere fun to him.

I was ordered to attend a brigade parade, which in those days was not

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the cut-and-dried operation of to-day. You were supposed to keep somewhere near the General and his staff, and the best tip for this was to keep him in sight, and never get in his or anyone's way. This was a difficult matter on a strange horse, with others galloping about in all directions, and the knowledge that to a certainty, if you lost your horse, or he lost you, there would be a terrible march across the sand. My mount this day was drawn from the Royal Artillery.

"Don't mess his mouth about, sir," was the advice of the orderly to my anxious inquiry, "Is he quiet?" "All right," I replied, "I'll take care of him." We walked off quietly, but I soon noticed that my mount was restless, and was looking out in one direction for his battery and ignoring me. He pulled a little, and got sideways so that his course was N.W. and mine about E. This condition of things was making me anxious, and I felt I must exert myself, but reckoned without my host. Gripping tightly, I took two strong pulls, when he "bucked" high into the air, but luckily did not shift me, and after some kicking and plunging was going "fourteen annas" across the long valley, taking everything in the way. I had lost all control over him. On he went, in a straight line for his battery, which was marching quietly for the *rendezvous*. "Sit tight, doctor," cried the major, and rode out to me, and cursed the beast, which suddenly started again for the lines in Aldershot, but later becoming blown, he went easier, so I turned him round, but he again made for the barracks, and I felt I could not stick on much longer. Eventually I reached the stables, where he stopped, and a friendly farrier hearing my story said, "I'll put your curb down a bar, and turn him round." I replied, "No, thank you, I don't want to break my neck," and I walked home.

Notwithstanding all the hard work at Aldershot, the life was very charming. We were in the rudest health, and had splendid appetites, and were easily able to add to our work games of all sorts. We spent many a pleasant afternoon rowing on the Basingstoke Canal, and having tea at the "Fox and Hounds," Fleet. The monotony of mess life was varied by guest nights, and I recollect one special one when some very convivial guests spent the evening. One of these had driven over in a trap, and on leaving managed to drive on to our drill square where he lost his bearings, and drove all over it in a thousand and one directions till he was rescued. At the next morning parade we saw the well-marked gyrations in the sand of the parade ground made by our guest. It was very comical.

Every Sunday we went to church in the morning, which reminds me of a very good story of Moody and Sankey, the Revivalists, who had visited Aldershot a year earlier. Mr. Moody, with his colleague, lived during the week at Farnham, where he had his quarters, and Farnham was a favourite resort for soldiers, where they could spend their Sundays in peace and beer. One bright Sunday evening, Mr. Moody, after a day's hard work at Aldershot, was walking home in the moonlight when he met a soldier well filled up with beer returning after a day's rest at Farnham. This man

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was noticed by Mr. Moody to lurch across the road every now and then, and he easily guessed the reason. When they met, Mr. Moody is supposed to have seized him by his coat, and said, "My dear friend, it pains me to see a man on this beautiful moonlight night suffering from the effects of liquor." The man asked, "Indeed, and who are you?" to which Mr. Moody replied, "A soldier like yourself." "Where is your regiment?" inquired the other. "Far away beyond those bright stars, far away beyond anything we have ever seen or heard," was Mr. Moody's fervent reply. "Really?" asked the man. "Really," said Mr. Moody. "Well, pal," answered the soldier "it's gone last post and you are a d——d long way from your barracks." This was the end, and Mr. Moody pursued his journey to Farnham, with a very good specimen of the resourcefulness of Mr. Thomas Atkins in a difficult position.

We had progressed with our drill, and were a good all-round class, and no one grudged us our fun, but there were sad moments, as when we lost our Surgeon-General from pneumonia, and had the mournful duty of taking part in our first military funeral. It was a very imposing sight, the band playing Chopin's Funeral March; the salute by rifle and gun, and the quick march home to the tune of "Far away." Surgeon-General S. H. Fasson had had a most distinguished career of forty years, and was about to retire, when death claimed him. We wore full dress for the first time, and were saturated by rain before we returned.

At the funeral we took no active part, as we had no knowledge of ceremonial, so Serjeant-Major Buckley was directed to remedy this omission. The Serjeant Major allotted certain parts of our drill square in the following manner. Pointing to a corner, he informed us that it was the cemetery, and a row of flags to this point represented the road the *cortège* would follow. In the distance was a young soldier with fat red cheeks, and a beaming smile, covered up with a white canvas suit. This man, the Serjeant Major informed us, was the "carpse." The procession started in the usual manner with the *cortège* in its proper place, and we slowly marched in the direction of the cemetery in an extended order in file with arms reversed. When the leading files reached the cemetery gates, indicated by a flag, they halted in succession, and turned inwards, the *cortège* halting at some little distance till all were up. We were enjoined to look sorrowful, and so sad did Buckley look that he must have felt he was at a real funeral. He then gave the remaining detail. The red cheeked one stood in his canvas suit awaiting further orders. When the Serjeant Major was satisfied that all was correct, he roared, "Advance the carpse," and the "carpse" marched slowly to the cemetery gates. Then in the twinkling of an eye we formed fours, and marched quickly back to quarters, taking the "carpse" with us this time. We behaved well, but were severely tried by this instruction.

It was nearing the end of the course, and we were wondering where our destinations might be. Eventually I was ordered to the North British

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District. I was engaged to be married, and required a few days' leave for the purpose, so put in my application to Surgeon-General Sinclair, who sent for me and said he could not entertain such a proposal for an instant. This scared me, but my anxiety was soon relieved by an approval of ten days' leave.

On the last day my brother officers gave me a handsome clock in bronze, which I value very highly as an expression of the excellent spirit of comradeship that existed between us in those happy days.

I was married during my leave of absence at Llangnydr, Breconshire. At the end of my leave I reported at Edinburgh to Brigade-Surgeon Lithgow, A.M.D., and was ordered to take up duty at the Castle. My duty in Edinburgh was temporary, and a few days later I was sent to Glencorse, the depot of the Royal Scots. I relieved a surgeon named Miller. He asked me if I wished to see the equipment and records he was handing over, and I replied most lightheartedly that I did not, for I was sure "everything" would be correct if he said so. Three months later I handed all over to another man, who discovered a vapour bath missing. I appealed to Miller but he knew nothing, and I had to pay. I have never since been caught in this way.

Later I was ordered to Jock's Lodge to take medical charge of the 3rd Dragoon Guards. I had a most delightful time with this regiment, and they took me everywhere, and made me quite one of themselves. Many a fine drive have I had in their coach driven by Major Park, who afterwards distinguished himself in South Africa.

The Egyptian war was beginning, and medical officers were being drafted in turn from stations, so I, as the junior, had to do general post over Scotland. Consequently, I was not left long with this regiment, and after a short notice was ordered to Fort George.

Fort George lies on a promontory jutting into the Moray Firth, and about a mile distant from Fortrose on the opposite shore. This was one of the principal guards on the frontier in the last century, and must have been very strong. At this time it was the depot of the Seaforth and Cameron Highlanders, since transferred to Inverness. Besides these, there were a master gunner in charge of the effete guns, some naval stores, a paymaster, and a few old pensioners. The hospital was quite a good one, and had done good service in its days.

I was seeing the sick one morning when a soldier came before me. He did not look ill, but reported that he had a headache, and did not feel well. While I was examining him he suddenly fell in a fit, and began foaming at the mouth, his face was congested and red as he turned his head from side to side, grinding his teeth. I had never seen a fit quite like this one, but was prompted to open his mouth, which I did with the handle of the ink-eraser, when out came a piece of soap. It was my turn now, so into his eye went my finger, and I kept it there till he sprang up and bolted. I felt no indignation, for I had learned something, and I knew that my soapy finger would be a caution to him in the future.

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The social side of the Fort was very pleasant. Every week the Mess was at home, and we played tennis and had tea.

There was much sport round Fort George, and when an officer went out shooting he was accompanied by "Rock," a fine old spaniel who lived at the Mess, chiefly under the table. He was very careful in choosing his companions, and would have nothing to do with any except those of commissioned rank. He often accompanied me, and took a very great interest in three collies I had, a dog and two puppies. Sam was the chief of these, and came to me as a puppy in 1879, and was at this time 3 years old. He was a clever, wise dog, and we were devoted to him, especially my father. When I left for India he remained at home, and on my return five years later he knew me quite well. He lived six years longer, and died at the age of 14 years, and is buried at Caerleon. I have owned many dogs in my time, but none have entered into my life so much as old Sam.

I made a collection of sea-birds, and obtained twenty-three varieties, principally from the Black Isle on the opposite side of the Firth.

Now I received orders to accompany a large draft of the 79th Cameron Highlanders to Portsmouth from Greenock At the latter place the 71st H.L.I. would embark for Dublin, and we would then take on the 2nd Rifle Brigade to Portsmouth. The day of departure having arrived, I marched with my charge to Fort George station and there entrained. At 10 p.m. we left in a bright moonlight. The men were gay and festive and had evidently marked their departure at the canteen. Song after song they sang, and were extremely hilarious. The only trouble they gave was getting out at stations and delaying the train by their requiring some retrieving and help to re-enter the carriages. Night evidently settled them, and they slept. We reached Greenock at 7 a.m. in cold rain and sleet, and the day's prospect was depressing and cheerless. However, things soon began to move, and when breakfast was over we were not long in embarking the troops and settling down in the "Lusitania," which lay anchored in mid-stream. It was my duty to accompany the embarking officer with the purser round the ship, and I was very conscious of the value of my contribution to their council. I knew as much about ships as I knew about dodos, and was a well developed "landlubber." Casting my memory back a few months to Netley and Parkes' Hygiene, I could think of nothing but the "Victor Emmanuel" Hospital Ship, and an essay on it by a Brigade-Surgeon Lieutenant-Colonel Corbyn, which was very good at the time it was constructed, as was Noah's Ark. I am glad to see Firth has removed the old ship to some dry dock. Now we know all about a vessel or ship, and are ready for any contingency, from the captain's deck to the bilge line.

I chased up and down the gangways because the ship was at anchor, and looked into everything.

A little later the weather cleared as we steamed down the glorious Clyde. The sun shone brightly; the air was crystal clear, which greatly

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enhanced the beauty of the Firth. Passing along one side of Arran, we began to see the open sea in front, and all was pleasing and quiet. After dinner we were leaving the land behind us and the sky became overcast and dull, so not being a good sailor I retired to rest, and was not over comfortable there. The next morning I rose and went on deck; the sky was clear and the air calm, and the sea like silver under the rising sun. The ship was steaming in sight of the Isle of Man. After breakfast we saw the Irish coast, and very green it looked, as we passed by the Hoe and turned into Dublin Bay, close to H.M.S. "Belle Isle," which was anchored off Kingstown. We disembarked our troops, and made ready to take the Rifle Brigade to Portsmouth en route for India.

I took advantage of the time before re-embarkation to run up to Dublin. I had never seen it before and I have never seen it since.

I returned to the ship as the embarkation was taking place, and shortly afterwards we steamed out of the harbour into a rough sea, wind, sleet and hail. I just managed to do the necessary duty, and for the rest I suffered the most appalling sickness. I never felt so ill in my life. The ship performed every possible gymnastic feat calculated to disarrange my gastric apparatus and disturb my brain, and I did not become normal for a long time. A day later we rounded Spithead at Portsmouth, and reached smooth water.

In due course I disembarked, reported my departure, and paid a visit to headquarters at the War Office. I had a request to make, which was that I might proceed to India for a term of service. I had always been greatly attracted by that country, and also by the idea that I should be better off.

When I reached the War Office I was told to write my wishes on a piece of foolscap, which judging from subsequent events I must have done in a most slovenly manner, and in atrocious English. I was then led into the presence of Surgeon-General Sir William Mackinnon for the first time. He looked at the hieroglyphics on the foolscap, glared at me, and whizzed the paper into the fire, and ordered me downstairs to re-write my application properly, to spell correctly, and not to murder the Queen's English. This pulled me up, and I returned and expressed my regret at troubling him. I got a fine lecture, and was told to read the Queen's Regulations on correspondence, a publication in which I had so far taken very little interest. The Surgeon General read my second letter and noted it, telling me to get ready, as the application would be favourably considered. Later I shall return to Sir William, who became one of the kindest and most generous friends I ever had. In his later years, when he was far from well, and suffered pain, he used to like me to go and see him in Evelyn Gardens, and when he was at the War Office he insisted on my calling on him every day. At this time I was Adjutant, V.M.S.C., London.

I returned to Fort George delighted with the prospect of foreign service, and had not long to wait before orders arrived warning me to sail on the H.M.S. "Euphrates" on December 17, 1882.

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We left Fort George after my short term of duty there with many regrets. Everyone had been particularly kind.

My wife and I embarked at Portsmouth on a frosty morning in H.M.S. "Euphrates," which would be our home for a month. A little way off and anchored in the tideway was H.M.S. "Victory"—Nelson's flagship—looking so gallant and proud, as, dipping our flag and saluting, we slowly passed towards the Channel. Turning the Spit Fort we gained the open Channel, and steamed on our course; the land became fainter and fainter till lost to view.

I was junior medical officer, my chief being Surgeon-Major J. Wilson, Surgeon-Major Roche was second. I was, at once, told off as orderly medical officer, and it was not long before I had to inspect the rations for the day. Here I made my first acquaintance with salt junk. A barrel was broached for my inspection. I considered it very good, as it did not smell. The petty officer handed me a potato with a grave salute, and then there was a pause, as I balanced the potato and looked all round. "Will you test the brine, please, sir," said the petty officer, kindly taking the mealy one from my hand and throwing it on the brine, where it floated, showing the brine was good. I felt rather aggrieved with Parkes' Hygiene, because in all its splendid tips to the embryo medical officer it never related this potato stunt. It was very obvious when I saw it.

My berth was in the "horse boxes" and a grade above pandemonium, the lowest berth in the ship, occupied by the most junior officers, and over the screw.

On the fifth morning after embarkation we descried Finisterre on the port bow, and began to feel some relief from the rolling we had had in the bay, the air too seemed more genial and less cold. We passed several small boats here, more or less open, and sailing like a miniature fleet, and learned that they were British returning from the sardine grounds.

The fishermen come from South Ireland, South Wales, and Cornwall, and are the members of a very old fishing industry. How they manage to sail those seas is past comprehension, but they do, and disaster I am told is infrequent.

An hour or so later we were running down the coast of Portugal, and near enough to be able to recognize objects easily. The sea was quiet, and for the first time we could appreciate the climate of this delightful stretch of Europe. The dangerous and cruel rocks that face the Atlantic stood out boldly, and the terrible danger of proximity to them in a storm was very evident. The ill-fated "Roumania" was lost here, and later we were passing the scene of the tragedy from which only five souls escaped. I knew some of the passengers intimately, and remember the terrible news reaching India.

Our appetites returned and we paid ample justice to lunch, for it was the first meal we were able to enjoy since leaving Portsmouth. Later we sighted the Berlingas (Berlings), which consist of four or five rocky islets,

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two or three miles off the shore. The captain took us through the channel between them and the main land, the only time I ever went so near. As a rule ships pass ten or more miles west of the Berlings. We saw the lines of Torres Vedras in the distance, the King's Palace near Lisbon, Cintra, and the position of the base hospitals in the Peninsular War. We passed Cape Roca, and turned seawards as night approached.

The following morning we passed close to Cape St. Vincent and Cape Trafalgar, and sailed in a beautiful health-giving breeze towards the gates of the Mediterranean. The current from the inland sea is very strong, and progress, at the best only thirteen knots, dropped to ten. Towards evening the lights of Cape Spartel were seen on the right. This is the north-west cape of Africa, and on our left Tarifa light, Cadiz, and some other places could be located by their lamps.

Gibraltar is a fine sight from the sea, and looks majestic and powerful. On the opposite coast is Ceuta, or the Spanish Gibraltar. In the distance are the cork woods full of pleasant associations. In the old days it was not so difficult to transfer patients from one station to another, and I was told that a hundred years ago a certain regiment stationed at Gibraltar received its orders to move to Malta. The M.O. in charge paid a visit to his regimental hospital, and simply announced, "The regiment will march to Malta on Monday, those unable to go will remain behind." He had no further trouble, and all sailed to Malta.

Three days later we passed into the Grand Harbour of Valletta. This is very large and deep, and a number of ships were there. I remember as we entered on another occasion seeing the ill-fated "Sardinia" on fire. She was a pilgrim boat leaving Malta when the alarm of fire was raised. In addition to pilgrims she carried oil, and the flames and smoke shot up a great height into the air, making a dreadful tragedy. We were too far off to render any help, but we saw some men jumping into the water, when the "Sardinia" no longer steered, and flew round and round under her own steam. It was a shocking calamity in which a large number of lives were lost, but some escaped.

Leaving Malta in a fresh breeze we commenced our voyage to Port Said, 600 miles. The Sicilian coast was just visible in the evening light, but not Mount Etna. This mountain and Stromboli are seen from the Straits of Messina, and form a striking and wonderful sight by night. We were soon out of sight of land, and began to feel the wind blowing down the Adriatic. Sometimes this wind is piercingly cold, more especially with a nor'-easter. Whales are sometimes seen, and porpoises are frequently passed, while birds flew about us all the time. The weather was beautiful, and the sea quiet and of a rich blue colour; but more often it is a rough sea, and can be far worse than the Bay of Biscay. On the third morning after leaving Malta it was reported from the bridge that the Port Said lighthouse had been seen.

It was here we noticed that the blueness of the sea had given place to

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a dirty yellow muddy staining. The reason was that we were opposite the Delta of the Nile, the discoloration being due to the mud and sediment of that river. We could see Aboukir Bay where Nelson fought the Battle of the Nile; and the Rosetta Lighthouse. We soon reached the breakwater and entered the harbour.

Port Said in 1882, when I first saw it, consisted of a row of buildings in the front, one street, and an Arab quarter which was very dirty, and very different from the present large and modern port. We coaled and commenced our journey through the canal, with powerful searchlights to aid us by night. Night in the desert was very beautiful, and the stars overhead were brilliant, but it became cold.

We were amused at one place on the left bank observing a signpost, "To Jerusalem," then only a track, now a fine road. As we passed Lake Manserah we saw all kinds of duck and armies of red flamingo standing in long lines with an almost military precision, and the sacred ibis. Towards evening, having crossed Lake Timsah, and approached the southern end of the canal, the most exquisite colours pervaded the sky, and some striking and beautiful effects of mirage appeared. It was very strange to see a beautiful castle or a lake surrounded with trees delineated in colour on the sky, and also ships upside down.

The *gares* or stations were very quaint and pretty, and there was the residence of the Emperor Napoleon and the Empress Eugénie on a low line of sandbank not far from Suez. What a history is conjured up suddenly by these illustrious names!

At 10 a.m. the next day we reached Suez, and cast anchor in the gulf of the same name which separates Africa from Asia. The scene was entrancing. On the right were the bare rocky hills of Egypt, and on the left the desert flanked in the distance by the Siniatic range, while in front and near the shore was an oasis with a few trees, known as the Well of Moses. "He was baptized here," said a young officer. "No, no," came from the bass voice of another, "You are thinking of the Jordan." Then somebody advanced the claims of the Nile with success and the argument ceased. This part of the gulf is infested by sharks, brownish creatures of immense size with very ugly heads. These catch many poor natives in a year.

Our ship's papers being cleared, we steamed down the lovely Gulf of Suez in a beautiful light. The air was delightfully pure and warm, and as the sun dived to the west behind the roseate and rocky hills of Upper Egypt it changed every moment till lost to sight, and then after a brief twilight darkness succeeded.

The next morning we steamed out of the Gulf into the Red Sea and the heat became very trying and oppressive. We passed the Daedalus light, the last guide, till we made Perim three days later. In 1882 travelling was not as comfortable as it is to-day, there were no steam-driven punkahs or electric fans, no ice, and the ships were much smaller.

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Passing close to The Brothers, which are two coral islands, we soon lost sight of the land, and it became hotter and hotter, with the prevailing winds from behind. Sails were set to help the steam power, and we sweltered. During this time the ship soon became unbearable, live stock began to die, for we had no cold storage, and cattle, sheep and fowls were all carried. Every now and then a fireman would be brought from the engine room with heat apoplexy, and we all felt exhausted and anxious.

To relieve this the captain changed the course and steamed across the breeze, causing a draught and bringing some relief ; even the nights were as oppressive as the days. The redness of the sea was a theme of great interest. It is due to masses of medusæ floating on the surface.

The Red Sea is of extreme interest and teems with fauna of all kinds, especially of a desert and marine character. It abounds in coral rocks, atolls, reefs and islands. Pearl fishing is carried on extensively, and the perils and dangers incurred by the divers are considerable. The pearl divers' boats are well built and made locally. The front is covered by a skin drawn tightly over the timbers where they meet. A religious function takes place at a launching, when an animal is sacrificed and the skin stretched on the boat.

Sharks infest this sea but are very shy animals, and only attack when the advantage is all on their side. Some fish of the skate tribe are very large, and I read of one caught in this sea which measured twenty-four feet across. I also remember once, on returning from India in the "Syria," experiencing terrific weather in the Bay, and seeing the waves as we rose rolling like a huge mirrored wall on each side, and on its face a skate evidently stunned by contact with the ship, and quite as large.

The temperature of the Red Sea averages 79° to 90° or 100° F., but it can be cold. The air temperature is much higher, and is only cooled by occasional sand storms, which are a very uncomfortable experience.

The lee shore after passing the Daedalus is not seen again till half way through, and then Jedda and Mocha appear, and twelve rocks called The Apostles. On the weather shore there is nothing of interest seen.

Towards the end of the six hundred miles of Red Sea, the shores gradually approach each other. We steamed by Jebel Tir, in a belt of intense and depressing heat, and began to look forward to entering the Indian Ocean. Perim is a small island at the mouth of the Red Sea, and divides the waterway into two channels, a large one on the African side, used by ships proceeding west, and a narrow one on the Asiatic side, used by those travelling in our direction.

The stream is very rapid through the smaller strait, and we quickly reached the open sea with Arabia Petraea still on our left, and Cape Guardafui, far away in Somaliland, on the right. Our course was direct for Aden.

After tea the barren rocks of Aden came to sight and a little later we rounded a corner of the Bay and anchored off Steamer Point, where it is

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needless to add we all went ashore. My experience of three visits to this station are favourable, and I am not at all sure that I would dislike a tour of service there. Certainly it is a small station in Arabia, but visitors arrive daily from every part of the known world, and there is proximity to the wonders of the mysterious land. The difficulty until twenty years or so ago was water, for Aden is practically rainless, but when an occasional storm breaks, it is a heavy downpour, which the natives catch and store. A mile or so above Steamer Point and the native town are fifteen huge tanks, built, according to traditions, by the order of King Solomon. They were nearly empty when I saw them, and the water left was of a most uninviting quality. Cholera was once frequent, but of later years has almost disappeared in the presence of improved sanitation and a pure water supply derived by condensation from sea water.

It was hot whenever I visited Aden, but less than I expected. It is not the heat so much as the oppressiveness, ennui, and staleness that are so trying to the residents. The harbour is much infested by sharks, yet the Somali boys dive into the sea without fear. I saw one youngster whose leg had been bitten off by a shark, and he was again shrieking "Hab a dive, hab a dive."

An American on a liner is reported to have approached another passenger leaving Aden, and said, "Stranger, if I owned hell and Aden do you know what I would do?" "Indeed I do not," replied the other. "Well, sir, I would live in hell and rent Aden." Notwithstanding the Yank's opinion, many think otherwise and they may be right.

On the fifth morning after leaving Aden we woke up to find our ship running into harbour, passing Colaba lighthouse on the left, and a rocky shore on the right, as we approach Bombay. This is India, the land of regrets, in which I have to spend many years. The ship slows down in speed, and at 7 a.m. we anchor in mid-stream opposite the town.

Current Literature.

The Supply of Cooked Food in the Field. Major C. T. Beckett, M.C. R.A. *Journal of the Royal United Service Institution.* May, No. 498.

For the past ten years numerous trials have been made regarding the supply of food to troops in the field. The first problem arose out of the question of the most economical fuel for use under active service conditions. In most eastern countries likely to become a theatre of war it is difficult to obtain coal or wood as a local supply and the importation of these bulky commodities requires the appropriation of considerable shipping and rolling stock. Shipping of petrol does not present great difficulties and sources of supply are often conveniently placed for possible theatres of war.

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In 1922 experiments were carried out at Aldershot with the object of adapting existing cooking vehicles to the combustion of heavy fuel oil. It was found that horse-drawn cooking vehicles could not be adapted economically. Attempts were then made to achieve combustion of heavy oil on a trailer behind a mechanically propelled vehicle, but though the results were promising many technical difficulties were found with a vehicle of the trailer type. A prime mover was then tried with considerable success. But before these experiments were finished the development of mechanization made it certain that petrol would be in the possession of every unit and formation.

Experiments with petrol as the fuel supply for cookers were tried on two lines: (*a*) to atomize the petrol and present it as a gas mixture of which ninety-five per cent would be air; (*b*) to mix the petrol with air just before ignition, the petrol being ignited under pressure. The first method proved too expensive, but the second seemed likely to be efficient in the hands of troops and experiments with it are being continued.

The trailer has been accepted now as the most suitable vehicle, because when in store it does not immobilize an engine which might be used for a general service vehicle. Three sizes of cooking stoves are suggested for use: (1) A single-burner stove with which every armoured fighting vehicle would be equipped, to be used during operations when separated from Echelon B vehicles. It can cook for ten men. (2) A two-burner stove for Infantry Brigade H.Q., Cavalry Brigade H.Q. and Artillery Brigade H.Q., for whom no apparatus has been provided in the past. These stoves are designed also for carriage in pack so that they may be issued in convenient multiples for larger units where special conditions would make the general service type inappropriate. They are designed to cook for fifty men. (3) A general service type which is designed to cook for 250 men, but with the use of insulated cooking its output may be doubled. This type may be used as a stationary cooking range on the lines of communication or, mounted on a trailer, may be issued in multiples to mobile fighting forces.

Each of the stoves cooking for fifty men and for 250 men is provided with an oven, so that half the complement may receive roast, while the other have boiled or stewed.

While the cooking apparatus was in process of evolution experiments were made to determine the best manner in which food can be cooked and delivered in convenient quantities to the troops.

Tests were made with the hay-box cooking—now known as insulated cooking—at Aldershot in 1924. The crude haybox was found unsuitable and after many experiments boxes made of metal-faced 3-ply wood, known as plymax, and insulated with kapok wool, were found the most suitable form of insulator. The heat to which these boxes were subjected and the long periods that they were exposed to the corrosive action of the food which they contained, made the introduction of "staybrite" stainless steel imperative. Aluminium was found to be unsatisfactory in the shape and form in which it was required, while the saving in weight was inappreciable.

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The size of the container in which the food was to be cooked and delivered was discussed for some time and it was finally decided that a one-gallon container and a six-gallon container were the most suitable volumes in which to issue the food, the one-gallon containers to be issued in pairs so that two kinds of food might be sent at the same time to the small parties for which they were intended.

The maximum quantity of hot food to be delivered to each man was settled at two meals, each of two pints, per day.

The kitchen trailers with their tractor vehicles will normally be brigaded under the Brigade Transport Officer with the other "B" Echelon vehicles. The location of the vehicles and their distance from the troops will depend on the military situation. They may conceivably stay with their units. When they are at rest the food will be cooked at any convenient time and then be placed in the insulated boxes to continue cooking when necessary. For ordinary insulated cooking it is only necessary to bring the food to the boil and its cooking, therefore, continues in the box. The food continues hot (140° F.) for ten to seventeen hours according to the size of the box; this system allows a very wide discretion as to when it shall be despatched to the troops. The food can remain in the boxes until the tactical situation, or the absence of congestion on the roads, permits it to be delivered to the unit.

DE LANGEN, C. D. **Stone Formation and Diet.** *Meded. Dienst. d. Volksgezondheid in Nederl.-Indie.* 1929, v. 18, 315-33. 1 diagram. [Dept. of Internal Diseases, Med. Univ., Batavia.]

The author finds that if rats are fed on a vitamin A-deficient or a vitamin A-, Ca- and protein-deficient diet stones develop in the following order, bladder, kidney and biliary; whereas FUJIMAKI states that on the latter diet the order of appearance of the stones is reversed. On these diets the urine very soon becomes alkaline and shows numerous leucocytes and bacteria. The stones show a great resemblance to the inflammatory stones of human pathology. Bladder stones are frequent in the tropics. Data from the Netherlands East Indies show that 67 per cent. of bladder stones occur in the age period 1-15 years, but in most cases symptoms are referred back to early childhood, and probably 80-90 per cent. of cases begin at this time. The sexes are affected in the rough relation of 7 males to 1 female. The nuclei of these stones consist of Ca and Mg phosphates, leucocytes and blood and resemble those produced experimentally. Keratomalacia is endemic in Java, but it cannot be definitely correlated with the diet of the country. The vitamin A content of the average diet in Java is sufficient. The source of vitamin A in the native population differs from that of the Europeans and Americans in being chiefly from vegetable sources. Intestinal disease is frequent in the tropics; and in sickness, especially in alimentary disorders, the only food given to the infant is pap food without any milk, so there is little vitamin A present. Cases of kerato-

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malacia seen had all suffered from intestinal disorders for a long time. These infants receive a diet not only deficient in "A" but also in protein and phosphorus. One is struck with the bad nutrition of infants with keratomalacia or bladder stones, and in other cases the urine complaints can be traced back to a period when the child suffered from diarrhœa, etc., for a long time. These findings are made in patients from all over Java and explain the endemic distribution of bladder stone better than any theory of the distribution of vitamin A-containing substances in the food of the district. The intestinal disorders affect the absorption of the little vitamin A in the diet and also interfere with the water metabolism, so that the urine becomes concentrated and therefore liable to primary crystallization. The improvement of infants' diet in Europe and America, particularly in the greater use of fresh cow's milk, has caused a gradual disappearance of bladder stones in these regions. The incidence of stones in the tropics should be made to diminish by acting on these principles.

H. N. H. GREEN.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 5.

PILLAT, A. **The Frequency of Deficiency Diseases of the Eye due to Lack of Vitamin A in a Military Camp north of Peiping.** *Nat. M. J. China.* 1929, v. 15, 585-91. [3 refs.]. [Peiping Union Med. College, Peiping, China.]

Of 3,000 soldiers in a military camp north of Peiping, 209 were found to be suffering from some form of eye disease, the high incidence of which was considered to be due chiefly to the lack of vitamin A in the camp diet, although the severity of the northern winter for soldiers from the south was probably a contributory factor. "Nightblindness, pigmentation of the semilunar fold and of the fornix conjunctiva, Bitot's spots and wrinkling of bulbar conjunctiva, prexerosis of the cornea and real keratomalacia were found. The high number of keratomalacia cases, 13 per cent. of the total number with deficiency diseases, is remarkable. . . . Prophylaxis by a diet of green vegetables, fat or cod-liver oil would be easy."

A. F. WATSON.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 5.

BOASE, A. J. **Report on the Incidence of Pellagra in Uganda.** *Uganda Protectorate Ann. Med. & San. Rep. for Year ended 31st Dec.*, 1928. Appendix No. V. 89-94, 4 figs. on 2 pls.

The scale of diet for native prisoners in Uganda laid down in the Prisons Ordnance is as follows: maize flour, ground and sifted, or rice unpolished, 24 oz., beans, 4 oz., ground-nuts or sim-sim, 2 oz., salt, ½ oz. In addition, a weekly issue of 2 lb. of fresh vegetables or germinated beans, or two lemons or limes. Pellagra and xerophthalmia occurred in certain prisons in which the diet was in accordance with the authorized scale, though neither disease was reported from the prisons where food supplies

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depended largely on local produce and where fresh vegetables largely replaced maize flour in the diet. An experimental diet, of which the chief features were the introduction of a meat ration and insistence on a daily issue of fresh vegetables, led to the disappearance of pellagra and xerophthalmia in the two prisons in which it was instituted. It is claimed, therefore, that the dietetic advantages of local produce, notably sweet potatoes, over imported maize flour are clearly established. The utilization of local foodstuffs should therefore be encouraged, and, if revision of the scale of diet is contemplated, a greater latitude of choice should be allowed to local authorities. In this connexion it appears that each prison should be made self-supporting and that the first claim on prison labour should be for purposes of food cultivation.

[The simultaneous occurrence of both pellagra and xerophthalmia and the cure of both diseases by fresh vegetables receive explanation in recent work of E. MELLANBY (see *Kenya M. J.*, in press, and *Brit. M. J.*, 1930, Apr. 12th, 677), which shows the condition of sub-acute combined degeneration of the spinal cord associated with pellagra (and accentuated by high cereal diets) and infective conditions of the type leading to xerophthalmia are cured by supplying adequate amounts of vitamin A in the diet.]

DOUGLAS C. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 5.

Reviews.

MEDICAL ANNUAL FOR 1930. Bristol: J. Wright and Son. 1930. Pp. viii + 676. Price 17s. 6d.

Surgery.—This volume, as usual, gives a most interesting and useful survey of the advances in surgery for the past year.

Amongst the many subjects dealt with, the following are possibly of special interest to those practising surgery in the Service.

(1) Carcinoma. The improved methods of dealing with malignant disease by radium are described and quite promising results are recorded for growths of the tongue, mouth, tonsil, larynx and breast. In cancer of the rectum the results are much less certain. Reference is also made to the treatment by lead, with the warning that it should not be used before radium, or the activity of the growth may be enhanced.

(2) Burns. A good practical account is given of the treatment by tannic acid which appears to have superseded the older methods. Another treatment suggested is by spraying on horse-serum, which is said to lead to less scarring.

(3) Fractures. A valuable paper giving the end-results of a long series of fractures is summarized.

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A method of controlling the position of bones in compound fractures by means of bradawls and plaster is described.

The value of direct skeletal traction in the treatment is emphasized. The reaction of bone to metallic fixation is described and the routine plating of fractures is condemned. Some degree of osteitis occurs in many cases, and in about 75 per cent of cases the functional result suffered as the result of this inflammatory complication.

(4) Intestinal obstruction. In the treatment of this condition, as an adjunct to surgery the intravenous injection of hypertonic saline has gained in popularity, but anti-gas-gangrene serum is less favourably reported on.

The retransfusion of extravasated blood after citration, in cases of intra-abdominal hæmorrhage, is noted.

(5) Blood transfusion. Important practical observations are made on blood-grouping. The four-group theory of Moss contains the truth, but not the whole truth, and is a dangerous guide in practice, particularly with reference to the so-called "universal donor," who may prove a very dangerous person. The prospective donor should always be tested against the recipient and "cross-testing" should be carried out.

When using the citrate method the solution should always be *freshly* made in distilled water. Even when every care has been taken in grouping, etc., severe reactions sometimes follow for which there appears to be no explanation.

The newer methods of blood-grouping, based on the peculiarities of the red cells, are said to be more reliable.

(6) Post-operative treatment. Many interesting points are described with reference to shock, acidosis, vomiting, distension of the intestines, etc.

"The shocked patient is lethargic, while mental alertness and anxiety characterize the bleeding patient."

(7) Hernia. Different methods of operating are discussed, including one by E. M. Hodgkiss, of closing the gap by living fascial sutures from the rectus sheath, which appears of interest.

There are many other reports of practical interest, including surgical diseases of children; surgery of the blood-vessels; genito-urinary surgery; emphysema; cholecystography and surgical diseases of the gall-bladder and ducts; surgery of cerebral tumours with special reference to removal by the high-frequency current, X-ray diagnosis, etc.

References are given at the end of each article. An illustrated description of new surgical appliances is included.

As an epitome of, and reference guide to, the surgery of the past year, this publication is of the very greatest practical value.

Medicine.—Of special importance to the Service officer is an article on post-vaccinal encephalitis which should be read by all whose work involves the primary vaccination of recruits.

Diseases of the Heart. In the review of this subject attention may be

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drawn to the section on functional diseases of the heart which serves to remind the medical officer of the complex nature of many of these cases.

Tropical Diseases. Recent work on a large number of different maladies is ably reviewed by Sir Leonard Rogers. New treatments for malaria, blackwater fever, leprosy, kala-azar and sprue are reviewed, and a good résumé of the present position of knowledge of the *abortus* group of fevers is given.

The volume contains the usual index of new pharmaceutical preparations and medical and surgical appliances, a feature which is of great use for quick reference.

This volume is well up to the standard of its predecessors and can be recommended as one of the most useful publications issued in this country.

British Red Cross Society Hygiene and Sanitation Manual. By Lieutenant-Colonel G. S. Parkinson, D.S.O., late R.A.M.C., M.R.C.S. Eng., L.R.C.P.Lond., D.P.H. London: Cassell and Co., Ltd. 1929. 2nd Edition. Pp. xiii + 246.

The first thing that strikes one in roughly glancing through the manual is the orderly fashion in which the text is arranged, and the numerous and excellent illustrations which it contains.

Hygiene is a subject which includes some very dry reading, but Colonel Parkinson has treated it with such simplicity and straightforwardness that one's interest throughout is maintained. The author has the rare gift of describing what he has to say in everyday English, and this fact in itself makes the book of outstanding value, for it brings the subject within the understanding of all.

Nothing is absent that matters, and what is present is treated in its true and correct perspective.

I could not imagine a more suitable book, unless it were even more fully illustrated, for, apart from its contents, its size, its flexible yet strong binding, and the ease with which information can be obtained, make it ideal for the purpose for which it is intended.

Affections of the Eye in General Practice. By R. Lindsay Rea, B.Sc., M.D., F.R.C.S., Surgeon to Western Ophthalmic Hospital, etc. London: H. K. Lewis and Co., Ltd. 1930. Pp. xvii + 155. Price 10s. 6d.

This little book is rightly dedicated to the general practitioner. It is easy reading, and is very well printed.

The chapters are well arranged, and they deal with the diseases commonly met with in everyday life. The various affections of the eye are described simply, without too much technical detail, and the treatment laid down is just as dogmatic as it should be, and is easy to carry out.

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In the short chapter on errors of refraction the usual optical diagrams are wisely omitted.

The object of the book, however, is evidently forgotten in giving a description, sketchy as it is, of an operation for cataract.

Under injuries of the eyes we are told that the general practitioner should know what course to follow when the eye has been perforated. There follows the detail of a recent example of perforation, and the operation performed with success by the ophthalmic surgeon, while the only course followed by the general practitioner was to telephone at midnight to the specialist.

The chapters on examination of the eye in nervous and brain diseases are very good, and the therapeutic formulæ at the end of the book are of great practical value.

The illustrations are disappointing, especially the coloured plates of external diseases of the eye, and a coloured plate to illustrate plastic repair of perforation of the cornea is outside the scope of the book.

In the coloured frontispiece of the normal fundus one is asked to note the lighter colour of the arteries and the darker veins, but it is impossible in the diagram to distinguish arteries from veins either from the colour or size of the vessels.

The index has been carefully compiled and is excellent.

The price is 10s. 6d.; an outlay very well worth while for the young medical officer of the Services.

HÆMODYNAMICS. By P. B. Kittel, F.R.C.S. London: H. K. Lewis and Co., Ltd. 1929. Pp. xii + 196. Price 10s. net.

In this book the author discusses the mechanism of the circulation with special reference to the flow of blood in the veins and capillaries and the changes that result from varicosity. Œdema, both venous and lymphatic, is also considered. The concluding chapters deal with the author's experience in the treatment of varicose veins by injection.

THE SOYA BEAN AND THE NEW SOYA FLOUR. By C. J. Ferree. London: W. Heinemann, Ltd. 1929. Pp. xi + 79. Price 6s.

This little book deals in a clear and concise manner with the commercial and domestic possibilities of the soya bean, the value of which has long been appreciated in the East, but to which little attention has been paid by western nations until recently. The new flour is a product in which all the good qualities of the bean have been preserved. It is rich in fat and protein, closely resembling milk casein in biochemical properties, and is also a valuable vitamin-containing food.

The concluding chapter gives a number of useful recipes for the employment of soya bean flour in the kitchen. For this purpose it is used as an adjunct to the cereal flours and provides the proteins and fats in which those in common use are deficient.

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ACCIDENTS AND EMERGENCIES. By A. T. Gooding. London: John Bale, Sons and Danielsson, Ltd. 1930. Pp. 62. 1s. net.

This small book is compiled from the instructions laid down by the St. John Ambulance and British Red Cross textbooks, and is designed to be of assistance to those who have already studied these manuals and who wish to consolidate or refresh their knowledge of first aid.

It is often a great help to the student to find his subject matter presented from a fresh point of view and in a novel form. In this respect the book will be found most useful. A glance down the large print headings will suggest questions, and gaps in knowledge can be quickly discovered and remedied.

The sections on injuries and poisons are arranged in alphabetical order, and the section entitled "Important Memory Notes" has a separate detailed index, so that there is no waste of time in searching for references.

The medical officer who is concerned with the examination of Voluntary Aid Detachments will find in this book many suggestions for questions, together with the answers which he might expect to get from a well-instructed candidate.

DEMONSTRATIONS OF PHYSICAL SIGNS IN CLINICAL SURGERY. By Hamilton Bailey, F.R.C.S.Eng.. 2nd Edition. Bristol: J. Wright and Sons, Ltd. 1930. Pp. xviii + 268. Price 21s.

The author is to be congratulated upon having produced a book which fills a definite gap. It is profusely illustrated with excellent photographs, some coloured plates and line sketches, which add very greatly to its usefulness. Produced primarily for the use of fourth-year students, it may well be read by candidates for higher examinations and practitioners.

J. M. W.

Correspondence.

THE ADMINISTRATION OF QUININE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS.

SIR,—The education of one's grandmother is an ancient, evergreen and pleasurable pastime. Mutually pleasurable. Fortunately, Youth never realizes what an immense amount of enjoyment Age derives from the process. Were it otherwise, the fun would stop. What old stager has not hugged himself on hearing a youngster deride the monaural stethoscope, or scorn the recently revived word "diathesis," or explain why no one should smoke before the port is stoppered, or deny that there was a war of any consequence prior to April 1, 1916—the day on which the colt landed at Boulogne?

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Many years ago, during my first tour in India, we were absolutely forbidden to administer quinine by the intramuscular route. Lately, it has been most refreshing to have this prohibition explained to us by one of the boys; and especially so because I, and many others, have saved a goodly number of patients' lives by this method. Theorists and experimenters notwithstanding, and as matters stand at present, intramuscular administration is far and away the most valuable weapon which the general practitioner possesses when malaria is doing its worst.

Take another example: vaccination. For the past twenty-six years I have vaccinated many infants with three neat, circular marks. Effectual and artistic. But now a young friend of mine earnestly urges me to drop the habit of a life-time. Pointing to the error of my ways, he implores me to adopt the thin red line—two of them. Long practice and experience still incline me to favour the avuncular sign, and to distrust the formation taken up by the infantry at Waterloo. My young friend is distressed.

In your issue of April, 1930, under "Clinical and Other Notes," there appears an article entitled, "Forenote on an Alternative Method for the Administration of Quinine in the Treatment of Malaria." It seems that "The theory has been discussed at various times, but I do not know that it has been given any serious trial."

If by this the writer means that the method which he advocates has not yet been rationalized, has not been reduced to pH values and decorated with numerous plus and minus signs, he may be right. But when he talks of it as a theory, and his application of it as an experiment, he is entirely wrong. I do not object to the contents of the article any more than I object to being slapped on the back and addressed as "old cabbage" by a major of twenty-four months' standing; in fact, the enthusiasm and ingenuousness of the writer are as delightful as the confidential hilarity of the newly-fledged F.O. What I dislike is the transference of this ancient educational process to public print. As a disgruntled senior officer (to apply the popular modern cognomen) I firmly and good-humouredly beg to protest.

Freed from its trimmings—which, by the way, are admirable—the essence of the article is this: "The underlying idea was to administer the quinine at a time when the malarial organisms would be most susceptible to its effects."

Lay down your barrage when the enemy is coming over the top; not when he is lying snug in his dug-outs.

I first heard of this in 1900 or 1901; class of Therapeutics and Pharmacology; Professor Ralph Stockman. Again in 1906, when I was a lieutenant (O.P.) at the Royal Army Medical College. Since then I have met it, in theory and practice, wherever I have been in India, over a period of about eleven years. It is common knowledge to, and extensively used by, our officers and the members of the I.M.D.

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Why, then, is it not the routine method of administration ? Because, although it is the logical method, it is not always—or even often—practicable. Practicability depends on two factors : (*a*) The eccentricities of the disease. The attack may occur two hours before, or two hours after, scheduled time. Often the varying time factor makes it difficult to register a bull. (*b*) Clinical and nursing exigencies. . Under suitable conditions, when there is no great rush on beds, when nursing is allied to trained and intelligent clinical observation, and when M.O.'s are able personally to give a good deal of time and attention to their patients, the method advocated is *the* method. But during the malaria season in India hospitals are working under pressure, they are not all staffed by Q.A.I.M.N.S., or even by R.A.M.C. orderlies, and M.O.'s do not find it easy to devote as much time to individual cases as they would like. Under these conditions the method is beset with pitfalls which are so obvious that they need not be detailed.

However, we are delighted to inform your correspondent in Egypt that we know all about this method, and that we use it as frequently as possible —to our own satisfaction, to the benefit of our patients and to the glory of a not so very archaic Corps.

I am, etc.,

A. C. AMY,
Major R.A.M.C.

N.W.F.P., India.
May 24, 1930.

Notice.

PHOTOGRAPHY SIMPLIFIED—DEVELOPMENT.

THE second of a series of interesting booklets, published by Burroughs Wellcome and Co. under the title of "Photography Simplified," has just been issued ; this edition deals with the question of development by the most scientific and safe method—the time and temperature method—as well as the relationship between exposure and development.

The after-treatment of negatives by intensification or reduction is also described, the illustrations showing the difference between correct development, over- and under-development, and the improvement in faulty negatives which can be effected by using "Tabloid" Reducers or Intensifiers. Notes are included on developers in relation to particular classes of work.

This booklet is artistically printed and is of interest and value to those desirous of getting the best results from their exposures. To any reader mentioning this Journal the booklet will be sent post free by the publishers. Burroughs Wellcome and Co., Snow Hill Buildings, E.C.1.

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Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

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Communications in regard to editorial business should be addressed "The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, War Office, Whitehall, London, S.W."

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VOL. LV. SEPTEMBER, 1930. No. 3.

Authors are alone responsible for the statements made and the opinions expressed in their papers.

Journal
of the
Royal Army Medical Corps.

Original Communications.

THE HISTORY OF SLEEPING SICKNESS IN THE SUDAN.

BY MAJOR G. K. MAURICE, D.S.O., M.C.
Royal Army Medical Corps.

INTRODUCTION.

AFRICA experiences from time to time devastating epidemics of various diseases which depopulate districts and inhibit their economic development. It has been estimated that the population of the Lake District of Uganda was reduced in a few years from 250,000 to 50,000 by sleeping sickness, and to save the remnant it was necessary to transfer them elsewhere. The control of epidemics is, therefore, not only a medical problem, but a political one, and in order that those who have no medical knowledge may follow the story of sleeping sickness in the Sudan, it is necessary to describe briefly how the disease is spread.

Sleeping sickness, or human trypanosomiasis, is an infection by a protozoal parasite called a trypanosome, inoculated into the blood-stream by a tsetse-fly; in the Sudan normally by that species of tsetse known as *Glossina palpalis*. The bite of this fly is only harmful if the fly is infected. Once it is infected, it may remain so for life: throughout which time it may infect human beings when it bites them. Conversely, any human being harbouring trypanosomes in his blood may infect any *G. palpalis* that may bite him. Certain drugs clear the blood-stream of trypanosomes in human beings for a limited period, during which time a biting fly does not become infected. The disease may be, and often is, extremely chronic, and may cause death after ten years or more. It is usually diagnosed by detecting with the fingers enlargement of the glands

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of the neck, by puncturing these glands with a needle and discovering the trypanosomes microscopically in the fluid from the glands.

G. palpalis inhabits the banks of streams, preferably densely wooded ones. It will follow man 300 yards from the water, but seldom further, and it will not inhabit that part of a stream where trees, undergrowth and grass have been removed.

There is another type of sleeping sickness found in some districts outside the Sudan which is also carried by a tsetse-fly, but of the species known as *Glossina morsitans*. This fly is not confined to streams, but is found scattered through the forest far from water. Except for a few isolated cases this type has never been found in the Sudan.

There were two distinct epidemics of sleeping sickness in the Sudan; one in Mongalla Province, the other in Bahr el Ghazal. I have only described in detail the Bahr el Ghazal epidemic ; firstly, because it was the more serious; secondly, because I was concerned in it, and my recollections of it are still vivid. The pioneer work of the control of the disease was done by the medical staff in Mongalla, and we in the Bahr el Ghazal modelled our methods on their experiences.

My acknowledgments are due to Major J. M. McKinnon, Royal Army Medical Corps, for voluminous notes on the history of sleeping sickness in Africa and the Sudan, and to Major J. R. N. Warburton, M.C., Royal Army Medical Corps, for many of the photographs in this paper.

I.—The Spread of Sleeping Sickness in Africa.

The earliest mention of sleeping sickness is by a naval surgeon, John Atkins, in 1742, who described what he called a sleeping distemper among the negroes on the coast of Guinea. In 1803 Dr. Winterbottom, a Colonial surgeon, published an account of the disease as he saw it along the Bight of Benin. "The Africans," he writes, "are very subject to a species of lethargy which they are much afraid of, as it proves fatal in every instance." He described the somnolent stage of the disease and mentioned the enlarged glands of the neck, but did not consider them of any importance. "Slave traders, however," he writes, "appear to consider these tumours as a symptom indicating a disposition to lethargy, and they either never buy such slaves or get quit of them as soon as they observe any such appearance."

The disease was mentioned again in 1840 by Robert Clark, another naval surgeon, and from then on by many English and French doctors. Generally speaking, it was considered to be confined to the West Coast of Africa, with little tendency to spread east, though in 1887 Dr. Mense found it as a widely extended epidemic as far up the Congo River as Stanleypool. There is a good deal of evidence suggesting that Stanley's expedition for the relief of Emin Pasha in 1888 was responsible for introducing the disease into Uganda, though the disease was not reported there until 1901. Investigations then showed that the disease had been known

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to the natives for at least six years, and that many hundreds had died of it.

At this time the cause of the disease was not known, and in July, 1902, a commission, consisting of Drs. Castellani, Christy and Low, arrived in Uganda to try to discover it. Dr. Castellani found trypanosomes in a number of cases, but hardly appreciated the value of the discovery. In March, 1903, Lieutenant-Colonel David Bruce, who had been lent by the War Office to assist in the investigations, arrived at Entebbe, where Dr. Castellani was working. In the light of his own previous discoveries of trypanosomiasis in animals, he at once grasped the importance of Castellani's observations, and the cause of sleeping sickness in man was thus discovered. Lieutenants Gray and Forbes Tulloch were also on this commission; the latter unfortunately contracted and died of the disease. The extirpation of the population of the Lake District was averted by the Uganda Government through the knowledge thus gained, which enabled them to remove the remnant to a safer district.

Reports of the spread of the disease northwards in Uganda towards the Sudan frontier reached those concerned in the Sudan, and there was evidence to support the probability that the disease was epidemic in the Belgian Congo and French Equatorial Africa, not far removed from the Sudan frontier. Major Bray, in 1905, reported that he had met at Tembura, in Southern Bahr el Ghazal, an intelligent Arab, who had recently come from Zemio in French Equatorial Africa, close to the Belgian Congo frontier, and that this Arab had stated that there was much sleeping sickness there; that it had been brought there three years before from the Belgian Congo. With his report, Major Bray forwarded to Khartoum specimens of *Glossina palpalis* caught in the Sudan. It became clear to those watching these events from Khartoum that, although the disease had been confined to the West Coast of Africa for many years, the pacification of Africa, the abolition of tribal warfare, the opening up of trade routes and general freer intercommunication, were causing the disease to spread to the geographical limits of the carrier of the disease.

In May, 1905, therefore, a commission composed of medical officers of the Sudan Government was formed to investigate sleeping sickness in the Sudan. Lieutenant-Colonel Douglas Hunter, D.S.O., was president, with Dr. Andrew Balfour, director of the Tropical Research Laboratories in Khartoum, as member; other members were to be appointed later.

Towards the end of 1905, Major Dansey Browning was appointed member of the commission and left for the Bahr el Ghazal Province. He found that *Glossina morsitans* was common in the west of the province, and *Glossina palpalis* common throughout the south, but no cases of sleeping sickness were found. Captain Howard Ensor, D.S.O., continued and extended the work begun by Major Dansey Browning. Bahr el Ghazal Province is approximately the same size as Uganda, and many of the chiefs were unfriendly to Government; the investigations, therefore, were carried

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out under considerable difficulties. He furnished, however, valuable information on the distribution, habits, food supply and conditions influencing the range of both species of *Glossina* found in the province, and learned from a leading chief that many natives of the Belgian Congo had become infected with the "French disease." (French and Belgians were not differentiated by natives at that time.) In his report he emphasizes the importance of preventing immigration from the Congo, and of taking immediate steps to deal with the disease, should it be found later. His report states, "If such immigration takes place on the part of the natives in the hopes of escaping the disease, nothing can prevent sleeping sickness from becoming widespread in the Bahr el Ghazal unless proper steps are taken before and not after the disease has become common among natives living in the province." Ten years later, many thousands of natives immigrated into the province from the French Congo, with results that will be seen later.

The most important preventive measures that Captain Ensor recommended were the abandonment of certain posts ; yearly subsidies to chiefs on condition they kept watering places near their villages free from trees and shrubs ; the provision of fly-free rest-houses and watering places for persons travelling by carrier transport ; and the appointment of a British medical officer for southern Bahr el Ghazal, liberally supplied with apparatus and money to carry out such recommendations as the commission might make from time to time. Unfortunately, at that time the Sudan Government was not in a position to carry out these recommendations. Had it been able to do so in the southern Bahr el Ghazal as it was to some extent in the western Bahr el Ghazal, the serious epidemic that occurred subsequently in the former district might have been prevented.

For the next two years investigations were continued, and the fly areas were mapped both east and west of the Nile. Both species of tsetse were found along a thousand miles of Sudan frontier, from the junction of Bahr el Ghazal and Darfur to Ikotos in Mongalla, but *Glossina palpalis* was nowhere found at a greater distance than two hundred miles due northward from the frontier.

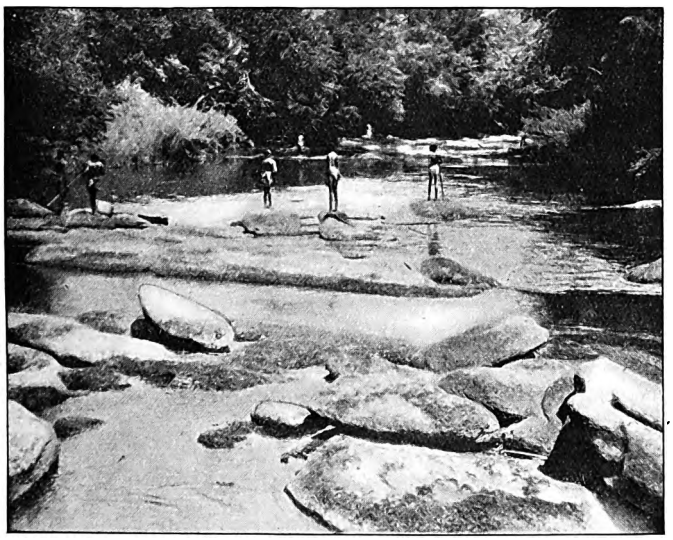
Although Captain Ensor had obtained information from native sources that the disease existed in the Lado, especially near Yei, which was then in Belgian occupation, in 1909, the chief danger seemed to lie in the western Bahr el Ghazal. Major Carroll, senior medical officer, Bahr el Ghazal, obtained information from a Greek merchant who had visited the French Congo in 1906, 1907 and 1909, that whereas no sleeping sickness had been observed by him during the earlier visits, he found on the last visit that half the population had died of it at Rafai and Djema, which are not many days from Raga in the Sudan, and that the disease appeared to be spreading rapidly northwards.

Measures accordingly were taken to meet this danger to the western district. There was at this time considerable trade between French

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Equatorial Africa and the western district of the Bahr el Ghazal. Quarantine camps were established at Raga and Dem Zubeir, and examining posts on the three main routes from the French Congo to the western Bahr el Ghazal.

Porters from the Congo were not allowed to cross the frontier, and donkeys were substituted to carry the merchant's goods. Local police were established at the examining posts to see that the regulations were carried out. At the same time watercourses on trade routes were cleared, and an isolation camp was made at Raga for any sleeping sickness cases that might be found. All persons arriving from the Congo were medically examined.



Typical resort of *Glossina palpalis*.

The Syrian medical officer at Raga reported that he had detained some suspicious cases at that station, and Captain Drew and Captain Ensor went to Raga to investigate. Two cases of sleeping sickness were found, and it seemed probable that a few others had died of it. All these were French Congo natives detained in quarantine. Since it is only through the co-operation of the chiefs that any anti-sleeping sickness measures can be made effective, all chiefs were warned that any immigrants from the Congo were to be brought to the station immediately for medical examination; for it was early recognized that the examining posts, though excellent for controlling trade routes, were useless against runaway slaves or immigrants determined to change their country.

These were the first two authentic cases found in the Sudan. The segregation camp and quarantine camp at Raga were rendered fly-free by

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extensive clearing. Immigrants were settled in selected villages on the main road and their watering places kept fly-free. Regular inspections of these people and of the local natives were instituted. As cases occurred, they were detained in the segregation camp.

From 1909 to 1929 some seventy cases have been detected in the western district of the Bahr el Ghazal, but none have been of Sudan origin. Early in 1910, the Sudan could be said to be free from sleeping sickness. The officers engaged on this work had done very valuable service. The various species of tsetse-fly were known; the belts they occupied had been mapped out for the greater part of the Bahr el Ghazal and, to some extent, east of the Nile; the effect of clearing streams of undergrowth had been demonstrated. Definite measures had been drawn up for dealing with an epidemic and were in operation in the western district of Bahr el Ghazal. The medical staff of the country was in a good position to cope with the situation which was shortly to engage their full activities.

II.—The Mongalla Epidemic.

By the terms of an agreement with the Belgian Government, the Lado Enclave—that is, the area round Yei and Kajo-Kaji—was taken over by the Sudan Government in June, 1910, to be incorporated in Mongalla Province.

It was known that sleeping sickness existed in the Lado, and immediate steps were taken to eradicate it. It is not proposed here to give details of how this was accomplished, since the difficulties encountered and the methods employed are fully described in the Bahr el Ghazal epidemic. The only difference in the two provinces was that in Mongalla the natives had been more closely administered and normally lived in villages.

By September, 1911, 268 cases had been detected in Yei District, and these were segregated in a sleeping sickness camp at Yei. In 1912, 140 cases, and in 1913, 139 were admitted; but in 1914, as a result of the past three years' work, the admissions fell abruptly to 24, and from 1914 to 1923 never rose above 32. From 1924 to 1928 there were no admissions; the district had been cleared of the disease. Of the 547 cases admitted up to September 30, 1913, 398 were still living in the camp on that date. The remainder had mostly died, and a few had deserted. Unfortunately, in 1914 the adjoining district of Kajo-Kaji was discovered to be infected, and by September, 1915, 187 cases were found in the district, and in the following year, 197. Cases were also found east of the Nile. At the same time that this largely-increased area had to come under constant inspection, the medical staff, which in Yei District had consisted of two British and three Syrian medical officers, was of necessity depleted by the war. Instead, therefore, of the epidemic being brought to a speedy conclusion, as had happened at Yei with a sufficient medical staff, the epidemic further east dragged on for another ten years. By the very strenuous

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efforts of the few medical officers left from the war, the admissions in 1917 for Kajo-Kaji were reduced to 95, and remained well below that figure till 1924, when an adequate staff was provided, and the admissions rose to 82, followed by a drop to three two years later, and from then on the district was free from the disease.

In Mongalla Province the patients were segregated in camps—three in all; one at Yei, one at Kajo-Kaji, and one at Nimule. The patients were housed and fed at Government expense, but were made to work for their treatment a certain number of hours a day. Communal cultivations of considerable size were, in course of time, developed; in addition, patients in their spare time made small cultivations of their own. In about seven years, when a number of patients at Yei had been discharged, the communal cultivations were large enough to support those remaining.

The yearly admissions for the Mongalla epidemic are shown below:

	Yei	Kajo-Kaji	Nimule
1911	268	—	—
1912	140	—	—
1913	139	—	—
1914	24	—	—
1915	17	187	6
1916	21	197	14
1917	14	95	4
1918	32	42	2
1919	15	63	8
1920	32	54	2
1921	24	31	12
1922	7	68	35
1923	3	5	4
1924	—	82	9
1925	—	10	9
1926	—	3	—
1927	1	—	18
1928	1	—	—
	738	837	123
Total Mongalla	..	..	1,698

It has been impossible to mention the various parts played by individual officers of the Royal Army Medical Corps in controlling the Mongalla epidemic.

Captain Colin Mackenzie, D.S.O., was the first British medical officer sent to the Lado. He was soon joined by Captain R. J. C. Thomson. Colonel Mathias, D.S.O., who was at that time Principal Medical Officer, visited Yei the following year, where he contracted malignant malaria, from which he died after his return to Khartoum. The outbreak in Kajo-Kaji was discovered by Captain H. S. Rankin, but before he could deal with it he returned to Europe for the Great War, where he was quickly awarded the Victoria Cross and shortly afterwards killed. For seven years Captain J. T. Simson was in charge, until he returned to the British Army and handed over the duties of the Senior Medical Officer to that very experienced officer, Bimbashi Yusif Effendi Derwish, who had found the first case for admission to the camp at Yei.

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III.—The Tembura Epidemic, Southern Bahr el Ghazal.

Although cases of sleeping sickness continued to be found among emigrants into the western district of Bahr el Ghazal, cases were not found in the south of the province until 1918.

In 1914 a medical officer of the Belgian Congo reported that the frontier adjoining the Sudan was free from sleeping sickness, but that there was a heavy infection of the Belgian-French frontier. In the spring of 1916 an expedition left Tembura to assist the French in quelling a rising. Some 800 levies of local chiefs were attached to the force. Captain Clarke, who accompanied the force as Senior Medical Officer, reported that the area in which the force operated was heavily infected with sleeping sickness. The 800 levies who at the conclusion of operations scattered to their homes were undoubtedly an original source of infection of Tembura District. But the chief source was a great influx of French natives into the district in 1917; thousands immigrated, and one party actually appeared at Wau, 200 miles to the north, and eight of them were found to be suffering from sleeping sickness. Of another party that made its way to Raga, thirty-one were found to be infected; the majority, however, settled round Tembura.

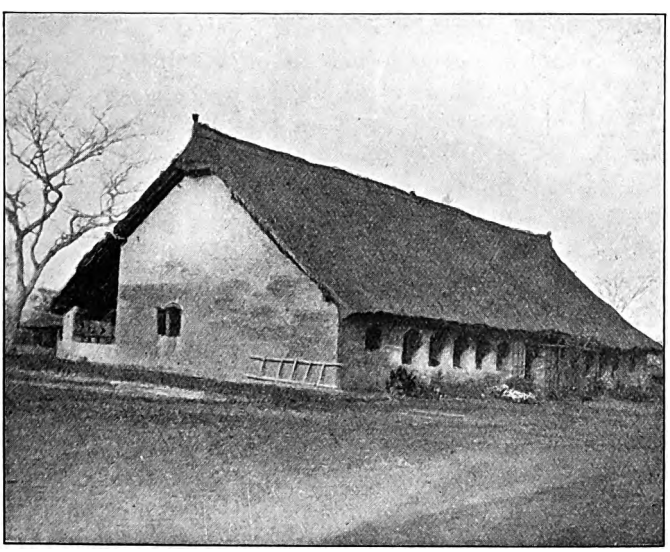
Tembura lies twenty-five miles from the French frontier and about forty from that point where the Belgian Congo, French Equatorial Africa and the Sudan all meet. The white population of Tembura consisted of the District Commissioner, the military officer commanding the native company and a Syrian medical officer, who had instructions to examine all immigrants for sleeping sickness. The Sudan frontier is geographical and not tribal, and intermarriage between natives of the three countries is a common event; therefore, infection of the Sudan sooner or later was inevitable, but, without the massive immigration, it need not have been on so extensive a scale. It was unfortunate that the Syrian medical officer at Tembura, in 1917, lacked experience of sleeping sickness and failed to detect a case, and the authorities in Khartoum were naturally startled when El Yusbashi Nesib Effendi Baz, who had had experience of sleeping sickness in Mongalla Province, arrived in Tembura in March, 1918, and discovered 60 cases in the first week and 255 in the first six months without going out of the station. Doubts were even expressed about the correctness of the diagnosis; exchange of telegrams was frequent, but Tembura lies 180 miles from the nearest telegraph at Wau and communication was by runner; to reach Tembura at all in those days, 800 miles must be travelled by steamer and a further 300 on foot. There was a great shortage of British medical officers, due to the War, so that for six months Baz had to battle single-handed with his ever-growing mass of patients.

By the end of August, 1918, Baz had cleared a site in the forest for a segregation camp, about a mile to the east of what is now old Tembura Station; he had cleared of undergrowth and rendered fly-free for drinking purposes the head of the adjacent stream, Maminza; he had built forty

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mud and grass huts for patients; two grain stores; four grass huts for officers and four for dispensary, office, store and prison. At this stage he was joined by Captain B. H. H. Spence, who had worked on sleeping sickness in Mongalla, and for the next fourteen months these two toiled together.

At this period the administration of the southern Bahr el Ghazal was short of staff. There was only one District Commissioner for the two districts of Yambio and Tembura. The most important native tribe is the Zande, who had spread north-east by conquest and practically absorbed the indigenous tribes. There was at that time no moderately accurate census of the people, no map of any value, no knowledge of the internal tribal



Amateur building. The finished article.

organization, nor any lists of important men. There were only two roads in the district, one north to Wau, one east to Yambio, and these were completely overgrown for half the year. The only rest houses in the district were on those two roads and were merely grass shelters, built on the banks of streams, which harboured fly. The rains begin early in March, reaching a maximum intensity in July, August and September, and end in the middle of November. By July the grass is twelve feet high or more. Rivers and streams become raging torrents or flat reedy bogs.

In spite of these obstacles, Captain Spence, assisted by Baz, traversed the greater part of the district several times and discovered that the epidemic was limited to a strip along the frontier about 150 miles long and 50 broad, and that the adjoining district of Yambio was not infected. He

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detected and segregated 621 new cases; made a census of the people; learnt their tribal organization; cut roads; built bridges and rest-houses; and with wheel and compass compiled maps of some 5,000 square miles of country, which were found to be remarkably accurate by the surveyors on a boundary commission some years later.

In addition to all this, he had to house, feed and treat his patients, who were a very primitive people, many of whom had never seen a white man. Moreover, he was expected to state his budgetary requirements in advance. There was difficulty in procuring hired labour for building huts and grain stores, and the white ants destroyed these almost as soon as they were built. To feed the patients was a problem of much greater difficulty. The highest tax that had ever been taken out of the district was 60,000 lb. of grain, and ten times this amount was needed. For months the supply of atoxyl, with which the patients were treated, failed, and the patients who had initially experienced the benefit of the drug subsequently became dispirited and many deserted. They were not an easy people to handle. Spence writes of them :—

> "Both sexes thieve and lie with facility. Intimidation, perjury, highway robbery and adultery are all regarded as venial offences. No man will work for anything he sees a chance of getting by force or cunning. They are foul feeders, inordinately fond of meat, devouring with gusto an animal in the most advanced stages of putrescence and liquefaction, Frogs, rats, snails and snakes are all common articles of diet; I have even seen a pet chimpanzee, which died of pneumonia, go into the cooking pot. . . . They are, nevertheless, a very intelligent people, and can, if they see good reason for it, work extremely hard."

He goes on to say that he thinks that, when a practical, civilizing influence is brought to bear on them, their pliability and relatively high intelligence will cause them to leave all other tribes in the southern Sudan far behind.

They were not an aggressive people. Spence travelled always without a police escort. Only once did he meet with the threat of active opposition, and that was from a band of those frontier rovers who belonged neither to the Sudan nor to the Congo, paid no taxes and supplied no labour. They sent a message to Spence that, if he came further on his march, he would be met with poisoned arrows. He promptly repacked his baggage and marched to the spot; the obstructionists bolted.

In October, 1919, the struggle seemed to be developing favourably. Inspection centres had been formed throughout the district, linked by cleared paths, and some semblance of a chain of responsibility had been established. The rabble in the segregation camp had been converted into an orderly community, organized on tribal lines, but desertions were still common. Communal cultivations had been established to supplement the food supply. A band of permanent employees had been recruited for

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general labour and the clearing of streams. But the pace had been too hot. Spence writes at this time :—

> "The work at Tembura at present is more than two men can possibly be expected to do and maintain their health in the tropics. Every day, except for an hour for breakfast and an hour for lunch, work lasts from 6 a.m. to 6 p.m., the office work, as often as not, being done in one's house at night at the end of a tiring day. I think it is absolutely essential that at least once a fortnight officers should have one complete day's rest; moreover, it is desirable that every day from 2 p.m. to 4 p.m. one should be free. Some prefer to rest, others to read or work at some hobby, but at least everyone should have the opportunity of spending these two hours as he chooses."

He had long been suffering from malaria and was in no fit state to carry on. His services, besides, were required elsewhere. The aftermath of the Great War had left a world shortage of doctors. The British Army still required every British doctor it could get, and the Syrian Universities had turned out no available doctors for five years. Before leaving Tembura Spence uttered a prophecy :—

> "It is a great pity," he writes, "that inspections must cease for want of an officer at the psychological moment when moral supremacy has been established. This is the very time for redoubled efforts and not for a total abandonment of all work for six months. The people will slip back, and it will all have to be gone through again."

Baz Effendi held the fort in solitary state. No inspections could be carried out; the people reverted to their old habits; the roads became obliterated and the rest-houses fell down.

IV.

So ended 1919. It must have been intensely disheartening to Baz, sitting alone in the camp at Maminza, collecting here and there fresh cases from the station; knowing, however, that outside in the district cases were accumulating fast, and that soon all the efforts of the previous year would be wasted.

However, a British doctor was forthcoming sooner than was expected. On January 15, 1920, Captain Watson, D.S.O., M.C., arrived at Tembura. But he had sustained a leg injury on the journey down and arrived in poor health and three days later died. Baz was alone again.

Spence had decided before he left Tembura that since the feeding of the patients was so difficult, and desertions so common, it would be better to convert the segregation camp into a Settlement, where patients could have their families and their own private cultivations, and become self-supporting. To prevent deserters to the Congo infecting fly *en route*, he thought the Settlement should be established close to the frontier, and

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suggested the source of the Yubo River as a suitable site. It was known to rise on the Nile Congo Divide, but had never been inspected or surveyed.

On arrival at Khartoum he put his views to the authorities, and permission to abolish the camp at Maminza and create a Settlement at Source Yubo was sent down by Captain Watson. Accordingly on February 20, 1920, Baz, in rear of his flock of 669 patients, set out for the source of the Yubo. He had sent in advance a working party to build a few huts and clear the head of the stream.

Baz, on arrival, found that his working party had erected the huts in French territory, and these had to be pulled down. The grass, twelve feet high, had not been burnt off and was needed for thatching the buildings. It is amusing to hear him describe those first few weeks: struggling through the long grass trying to map out a settlement; met at every turn by unexpected fly-infested streams. (An exceptional sense of humour saved him.) Somehow he laid out and cleared a most attractive site for the station headquarters; cut roads and allotted sites along them for the patients. One hundred and fifty thousand pounds of grain had to be brought from Yambio District, 130 miles away, by carriers; there was no other form of transport. Food became short, and numbers of patients deserted, but most of these returned of their own accord when conditions improved.

In May, 1920, El Yuzbashi Abdulla Effendi Mansur arrived and allowed Baz to go on leave. Baz had been over two years in the district, working at high pressure, half of the time single-handed. By tact alone he had transferred 669 primitive savages suffering from sleeping sickness to an unsurveyed, uninhabited patch of virgin forest twenty-five miles away, and had there created a settlement, abandoning the old camp he had originally formed near Tembura. And he had done this without a single desertion so long as the food supply held out.

Mansur carried on the work where Baz had left it, extending the cultivations and the buildings. But he could not leave the settlement, and thus it came about that for a whole year no inspections of the district could be carried out. For the year ending September 30, 1920, there were 192 admissions, all found among visitors to the Settlement, or among labourers, police or soldiery. It was realized that out in the district the epidemic must be gathering momentum.

In October of that year Captain J. M. Mackinnon arrived. He was agreeably surprised at the state of the settlement. The rains were nearing their end, and the patients' crops were the best he had seen in the district. The communal cultivations were still small, since the patients were all busy on their homesteads.

As soon as he had got a grasp of the working of the Settlement and conditions prevailing in the district, he restarted the tours of inspection as planned by Spence. Through the lapse of a year the roads cut by Spence were invisible; the rest-houses were in ruins; the bridges had been swept away; the people concealed themselves from inspections.

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Mackinnon proceeded to put the district into order again. In parts he was even able to ride a bicycle along the narrow winding paths worn smooth by native feet. But most of the work had to be done on foot, the bicycle carried, slung on poles. He would sometimes travel between twenty and thirty miles a day. He could get no rest in the Settlement, since to keep inspections going it was necessary when he returned for Baz to start a tour. There were no clerks to do the office work; there were miles of streams to be cleared in the Settlement and endless working parties to be watched throughout the day.

Often suffering from malaria, frequently drenched by thunderstorms, or by dew in the long grass, the inevitable happened: Mackinnon in August, 1921, the heart of the rains ten months after his arrival, got a bad attack of blackwater fever. Fortunately, when this happened, the officer commanding the company at Tembura had come to stay with Mackinnon to have his own malaria treated, and was able to carry out Mackinnon's nursing instructions. Baz was inspecting at the far end of the district but returned in record time, travelling day and night carried on a chair slung between poles.

At this time I was at Wau. News of Mackinnon's illness was sent me by runner, but took six days to reach me, and it took me another eight days to cover the 207 miles on foot to Source Yubo. When I arrived I found Mackinnon very weak but convalescent. It was unthinkable to attempt to get him out of the district at that season of the year through the high grass. The road to Wau had been closed for two years for sleeping sickness reasons. After a short stay I returned to Wau. Mackinnon resumed the administration of the Settlement and Baz went on with the inspections. For the year ending September 30, 1921, 656 fresh cases had been detected and segregated in the Settlement, bringing the total admissions to the Settlement to 1,517.

V.

MacKinnon passed through Wau on his way north for leave early in April, 1922. It had been arranged before I left Khartoum for Wau the previous July that I should relieve MacKinnon early the following year, but a patrol which lasted till the end of March against the Dinkas in the north of the province, had prevented me from starting for Source Yubo before he left. He had, however, told me very fully the requirements of the situation when I visited him at the time of his illness, and a few months' personal experience of the work confirmed everything that he had said. Briefly the situation was this. Tembura district was about 12,000 square miles in extent. To the east lay Yambio District, and beyond that again Meridi District, both more or less similar in population to Tembura District, and both potentially sleeping sickness areas. To the north was the Central District of Wau, but the fly-belt ended a little south of Wau. To the north-west of Tembura lay the Western District, but isolated from

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it by 150 miles of uninhabited forest and by tribes with different customs. To the south and west lay the French and Belgian Congo. The sleeping sickness regulations made it illegal for anyone to enter or leave Tembura District without permission.

The normal life of the tribe occupying the greater part of the three southern districts was a solitary life in the forest, each family living alone with its own huts, cultivations and watering place, in many cases miles from any other habitation. Nothing in the nature of a village existed. It was obviously impossible to clear and render fly-free individual watering places, and the only alternative was to group the people into villages round cleared watering places. It is true that to some extent the normal isolated life tended to hinder the rapid spread of the disease, but the Zande is an inveterate wanderer; at the first sign of sickness he consults his oracles and leaves his home in search of change of air. Hence, as the number of infected persons increased, so did the number of infected watering places.

The crux of the situation seemed to lie in concentrating the people into villages. The advantages of such a concentration were obvious. Village watering places could be cleared and maintained fly-free; roads could be easily kept open throughout the year; inspections could be carried out more frequently; immigrants from the Congo could be more easily detected and returned; chiefs and headmen would have more authority over the people.

But before so radical a change in the habits of a people could receive sanction there was necessarily some conflict of opinions. The question arose whether so much interference with the lives of a people was justifiable, and whether, if left to itself, the epidemic would burn itself out. In any event could the disease ever be eradicated? There was also doubt whether the Zande tribe could be made to live in villages. They had not been long or closely administered; they were wild and timid and too firm a handling of them might destroy such of their confidence as had so far been gained. The chiefs in the past had committed abominable atrocities and their power had been deliberately broken, and was the present the time to restore it?

There were, however, facts which seemed to answer these doubts. The disease had been eradicated from Yei District in Mongalla; the experience of the Lake District of Uganda had proved that the burning-out process was an expensive one. Several thousand Zandes were living quite happily in the Settlement, which consisted of a string of straggling villages, and it seemed probable that under the close supervision to which the district was subjected through our frequent inspections atrocities could not pass unnoticed and therefore could be dealt with and suppressed.

(To be continued.)

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POINTS FROM APPRECIATIONS, ETCETERA.

By Major A. C. AMY, D.S.O.,
Royal Army Medical Corps.

[The writer was privileged to act as *rapporteur* at a conference held at 10 Div. H.Q. (Med.) when the following officers were present:—

Colonel Sir Marmaduke Millbank, K.C.M.G., A.D.M.S., 10 Div.
Lt.-Colonel Percy Pondicherry, O.B.E., R.A.M.C., Cmdg. 34 Fd. A.M.B.
Major Cuthbert Crookham, D.S.O., R.A.M.C., D.A.D.M.S., 10 Div.
Captain F. Frensham-Fleet, M.C., R.A.M.C., Comdg. 14 Fd. Hygiene Sec.

The proceedings are recorded below.]

Col. M.] Gentlemen—we all know that an Appreciation is a military review of the actual situation culminating in a statement of the measures recommended to meet it. 1

I have called you together so that we may collaborate in the construction of a framework for our appreciation.

Lt.-Col. P.] Before tackling this task, may we see the appreciation of this problem which was elaborated in peace time? 1

Col. M.] As we are sitting *in camera*, I feel I may take the risk of informing you that no such appreciation was made. The present contingency was never visualized.

Lt.-Col. P.] Then, sir, may we read the appreciation which was written by D.M.S., E.F., at the outset of the campaign? 2

Col. M.] I regret that the time at our disposal is too limited to permit of a study of this monumental work. It is an encyclopædic essay, 3
a gigantic treatise. It is full and enters into every known and surmised 2
factor, however slightly it bears on the situation.

Major C.] Do you mean, sir, that this appreciation discusses such matters as the topography of the country as regards the roads, railways 4
and waterways of his particular lines of communication?

Col. M.] I do. It is founded on a narrative given by the General 5
Staff.

In my opinion, it is unnecessary to repeat in the appreciation all the information given in the narrative.

Capt. F.-F.] Hear, hear, sir! I do think it should be forbidden to 6
repeat any such information. Is it not on record that in the first volume

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of "The World Crisis" the naval situation on the outbreak of war was appreciated by Winston Churchill on a small sheet of Admiralty notepaper? There is a photograph of it in the book.

Col. M.] I hardly think a small sheet of Admiralty notepaper will suffice for our present purposes. Still, we should have a rough idea beforehand as to what will suffice.

Lt.-Col. P.] I do not understand how we can possibly do that, even approximately. All sorts of factors may emerge: the position and
4 relative strength of the opposing forces, the object to be attained, topography——.

Col. M.] My dear Pondicherry, you are in danger of being accused of
7 usurping the brains of the General Staff, and, possibly, of exercising your military intelligence to the detriment of your professional ability. Your
3 proposition would, in practice, never produce an appreciation which is brief, precise and deals with essentials only.

3 If you have information which is already in the possession of the G.O.C., or which cannot benefit him, keep it to yourself.

Lt.-Col. P.] Then, sir, may I ask what kind of an appreciation is
2 required? Up to date I have not thought it possible that the A.D.M.S. of a division would ever be asked for an appreciation.

Col. M.] Really! Then what do you make af amendment No. 6 to King's Regulations, issued under Army Orders for December, 1928?

Lt.-Col. P.] Well—when I was at the War——

Col. M.] In our present case the appreciation is of the second order
1 described in T. and M. Regs. It is to be rendered in writing, by me, A.D.M.S. 10 Div., to G.O.C. 10 Div., by to-morrow morning, Z—2 days.

6 Major C.] Then the G.O.C. will probably be a more or less harassed man with almost every minute of the day mapped out, and it is not likely that he will be able to give you a very extended interview?

Col. M.] That is so.

6 Capt. F.-F.] Hear, hear, sir! and, as the junior member, I suggest not more than three pages: two, if possible.

3 and 8 Major C.] And as the next in seniority, I'd say three and a half to four.

Lt.-Col. P.] Why, sir, this is preposterous! You cannot possibly ——

Col. M.] One moment . . . yes—the average (one member abstaining) works——

Lt.-Col. P.] If you please, sir, not "abstaining": "dissenting." At this stage you cannot possibly——

Col. M.] As you like. "Dissenting" . . . works out at 3·125
6 pages of typed foolscap. For everyone's sake one is entitled to ask that the typist, the typewriter, and even economy in foolscap may not be overlooked. However, as a concession to Colonel Pondicherry, shall we say 3·250 pages, less appendices?

Major C.] Sir, I beg to second that. Three and a quarter pages ought

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to be sufficient to supply the G.O.C. with the necessary medical and hygienic deductions and inferences to be drawn from the information the staff has given us regarding the military situation. 9

Col. M.] I congratulate you, Crookham. You went through it without drawing breath.

Then again, Pondicherry, the appendices, which need not be read by the G.O.C., may be expanded. I don't think one can make a mistake in having too many appendices. They are very useful, for we are all mortal. Should I suddenly drop down dead, my successor, a stranger, will be able to understand the situation and carry out the original policy by reading my short appreciation with its detailed, explanatory appendices. 8 10 11

Capt. F.-F.] Hear, hear, sir! Your appendices, I mean: not your sudden demise, sir.

Col. M.] Thank you, F.-F. The explanation is not unnecessary. And now, gentlemen, let us consider our "Object."

Lt.-Col. P.] What about form, Colonel?

Col. M.] Well—what about it?

Lt.-Col. P.] I venture to put forward my view that a medical appreciation is a specialized thing, for a special purpose, and that it is a square peg that cannot be successfully fitted into the round aperture of Sec. 25 T. and M. Regulations. 8

Major C.] With due respect, sir, I would submit that a special scheme for the writing of medical appreciations is never likely to find a place in regulations: for the sake of uniformity we must take things as they are and mould our appreciations accordingly. 3

It is impossible to ignore paras 6 and 7 of the Introduction to F.S.R. II.

Lt.-Col. P.] But so long as the reasoning is logical and leads up to a definite plan, the actual form of the appreciation is of minor importance.

Major C.] That was so in 1923; but A.O. 117 of 1926 ties the writer of an appreciation down to a definite formula. There is no alternative to adopting the formula laid down in T. and M. Regs. 1 9

Col. M.] Of course not. I quite see your point, Pondicherry; but it is up to you to so shape your square peg that it will, in the end, fit the round hole. This is not the only imperfect thing in a far from perfect world; and if you demand a special kind of appreciation to suit a special (medical) purpose, then you will next ask for special medical editions of Field Service Regulations, the Bible and Shakespeare. Heaven alone knows where it would all end: certainly in military ostracism. In the Army there is one thing you cannot, dare not, do: you cannot paddle your own canoe.

Lt.-Col. P.] Nevertheless, sir, most writers agree that the T and M. Regs. formula is unsuitable. 8

Col. M.] And so say all of us! But most writers certainly do not agree that, on that account, the formula should not be used. Indeed, I feel sure that most writers would condemn such a suggestion.

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Lt.-Col. P.] Sir—am I to understand that we are to be manacled by "uniformity," "co-operation," "co-ordination," and all those military catch-words which anæsthetize the imagination and ankylose initiative? Am I to suppose that the splendid, adventuresome individualism, which has always characterized the profession of medicine, is now to be shackled to a red tape factory?

Col. M.] Look here, Pondicherry, this is not a political meeting. I 1 would remind you that it is the duty of all commanders to see that the instructions contained in the training manuals are strictly observed. I propose to carry out that duty and, as Commander of the R.A.M.C. 10 Div., I intend to ensure that our medical appreciation—no matter how specialized —is, in fact, an appreciation in the official sense of the word.

9 *The form and sequence dictated by regulations must be employed.*

And now to the object. Any ideas on the subject, F.-F.?

3 and 9 Capt. F.-F.] I think you will find the object stated in F.S.R. II, 176.

7 Major C.] Oh! Why—it would be just as logical for a director of engineers to set forth in an appreciation his object as "The Construction and Maintenance of Barracks, Buildings and Fortifications, etc.", or a director of ordnance "The Supplying of Armaments, Repair of Machinery, etc." In fact, F.-F. has confused general functions with a special object.

Col. M.] Yes—I think so. Our present aim is to apply our general functions—where they are applicable—to the special object we now have in view.

Capt. F.-F.] But, sir, apart from general functions, what can our object possibly be?

Col. M.] That you will discover from a study of the staff's Special Idea.

9 Lt.-Col. P.] Then it seems to me that our object may resolve itself into an intelligence summary or a mere statement of information to hand.

Major C.] Colonel—I don't think so: not if we ensure that each factor includes a definite deduction. It is no use merely stating facts; it is the deductions from the facts which are important. In sizing up the points we must exercise judgment; we should select points which have a definite bearing on the situation, and from which deductions can be made.

Lt.-Col. P.] Well, it all seems to me to be much ado about nothing.

12 Col. M.] An appreciation is a method of arriving at a reasoned plan. That being so, I am bound to say that I prefer Crookham's long speech to your brief comment, Pondicherry.

Lt.-Col. P.] Sorry, sir.

Capt. F.-F.] Sir, what about the objective?

Lt.-Col. P.] Objective! What on earth is that?

Col. M.] Don't go too fast F.-F., one thing at a time.

1 The object should be clearly and concisely given and should be kept in

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view throughout the appreciation. It is important not to confuse "object" with "objective." The object can often be stated at the outset, but the selection of the objective, or objectives, to attain that object may only be possible as a result of an appreciation of the situation.

Major C.] May I give an illustration, sir?

My patient's signs and symptoms constitute a Special Idea, from which I appreciate that the malady is circumscribed peritonitis. My function is to bring about cure, thereby saving my patient's life, but my object is to remove the cause of the peritonitis.

In the course of the appreciation it transpires that appendicitis is a probability, and liver abscess a possibility. It therefore follows that my objectives are, firstly, the appendix; and secondly, the liver. In fact, the greater peritonitis includes the lesser appendicitis and hepatitis; and it is the greater which I keep ever before me.

Lt.-Col. P.] Bravo, Crookham my lad! To be sure, that is something one can understand at last—isn't it, sir?

Col. M.] It is. Moreover, Crookham's illustration emphasizes the fact that although the objective may demand special mention and attention, it must never be allowed to dwarf the object. Do not let the trees blot out the view of the wood. So once again, F.-F., let us have your ideas on the object.

Capt. F.-F.] On Z day the object of the R.A.M.C., 10 Div., will be to collect, treat and evacuate all casualties occurring within divisional boundaries from (exclusive) regimental aid posts to (inclusive) main dressing station.

Major C.] Ha! Same tune, different words. You gave us that ten minutes ago.

Lt.-Col. P.] Besides—what is the deduction?

Major C.] That you will do your job as laid down in F.S.R. and R.A.M.C. Training.

Col. M.] Precisely; and to tell the General that that is your object would be fatuous. Were I to do that, I should only just be in time to catch the afternoon train for the beach preparatory to buying a bowler hat. 6

Capt. F.-F.] But, sir, the object must be a constant as it must deal 9 almost invariably with the preservation of the health of the troops, prevention of disease, rapid evacuation and care of the sick and wounded from the area of operations, or perhaps some special points associated with one or other of these.

Major C.] Oh, F.-F.—you are a miserable ass—

Col. M.] Now—don't be impatient Crookham, this question of the object in a medical appreciation is not an easy one.

Major C.] I quite agree, sir, but, after all this talk, poor F.-F. fails to see that the object is governed by something which he has not even mentioned: the Special Idea. Indeed, the only thing of any value lies in his concluding remark: "or perhaps some special points associated with one or other of these."

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Lt.-Col. P.] To-night I shall dream of Special Ideas.

Col. M.] Then you are not altogether lost, Pondicherry.

10 Firstly, I know that most appreciations are spoiled by the inclusion of detail.

Secondly, I study the Special Idea and, so far as I can see, the R.A.M.C. is likely to function normally in the staff plan.

Thirdly, I try to visualize all possible contingencies and, with one exception, I see no reason to anticipate interference with normal functioning.

Fourthly, the aforesaid exception. On good authority we have it that typhus is rife in enemy territory. That demands special attention and mention.

Lt.-Col. P.] That is a very good summing-up, Colonel.

Col. M.] What think you, Crookham ?

Major C.] Here is an epitome of your remarks :—

Intro.—Clear and concise.
Firstly.—Special Idea.
N-thly.—Ditto.
Lastly.—Any abnormal circumstance.

It follows, sir, that the appreciation would begin thus :—

(1) Object.

(*a*) *Collection and evacuation of casualties. Conforms in normal fashion to Special Idea.*

(*b*) *Prevention of disease, and notably typhus.*

Col. M.] Presumably the General has confidence in me, or I should not be here. Let me try to analyse this from the G.O.C.'s standpoint. He says : " My Special Idea points to a bloody battle in two days' time. It is old Millbank's job to collect and get rid of the wounded, and to keep the Division healthy. His ' Object ' is in a nutshell ; he has considered it in the light of the Special Idea ; he sees nothing unusual, likely to interfere with collection and evacuation ; his hygienic sense indicates that the objective here is typhus. I am satisfied "—and perhaps he will add : " Good old Millbank ! " eh, Pondicherry ?

Lt.-Col. P.] Why of course, certainly, without a doubt sir. The 13 General is nothing if not perspicacious. It is only by knowledge of the part which each component portion of his forces has to play that he can ensure the effective co-operation of the whole.

Major C.] Hear that, F.-F.? That is why it is unnecessary to embroider the object. The full power of an army can be exerted only 13 when all the parts act in close combination, and this is not possible unless each arm understands the characteristics of the other arms.

Capt. F.-F.] H'm. If you and I broadcast that sort of talk, we shall be suspected by the Staff and unpopular in the Corps. Don't forget that 7 there has been a certain amount of obloquy aimed at the gentleman known as a " Red-hot Soldier."

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Lt.-Col. P.] Yes, Crookham, you cannot afford to be regarded as self-opinionated in these matters.

Col. M.] Really, gentlemen, I do think we are now in danger of drifting back to the Crimea. Speaking by and large, the G.O.C.'s object, as revealed in the Special Idea, is the defeat of the enemy's armed forces and the destruction of his powers of resistance. Should our efforts be directed towards the same ends—or should they not? 13

Omnes.] Of course they should, sir.

Col. M.] One is bound to admit that the Fighting Troops and the Medical Service stand on different planes, and must have different angles of vision; but the planes are parallel, and the lines of sight converge. That being so, I accept Crookham's object: quantitatively and qualitatively it fills the bill. So now for the second heading—"Considerations which Affect Attainment of Object." 3

Capt. F.-F.] I presume, sir, that only those considerations which actually affect the plan should be mentioned. 12

Col. M.] Yes.

Major C.] And once again, the considerations must show logical reasoning from which deductions can be made. 12

Col. M.] Yes. My object is to make such medical arrangements as will conform to the defence of our line as outlined in the Special Idea. Then the factors influencing our object stand out very clearly, and are detailed exactly in the Special Idea. 7

Lt.-Col. P.] Why "defence," Colonel?

Col. M.] A manner of speaking, Pondicherry. For "defence of our line" read "assault on the enemy," as the case may be.

Lt.-Col. P.] Sir, at this stage I should like to sympathize with the man who said that too many cooks spoil the broth.

Up to date I have studied ten different models of "Considerations which Affect Attainment of Object." I have been frozen on Greenland's icy mountains and baked on India's coral strand. I have been flattened by tanks, blown up by mines and sunk by submarines. I've been bitten by camels and mosquitoes, kicked by mules and chased by flies. I've been smothered in vermijelli, drenched with Paris green, dumped on a pile of extra stretchers and blankets, rescued by a salvage gang and lost in a gas cloud which, they tell me, smells of horse radish.

We are sick of discomfort in trenches 14
All twisted by mortars and shell,
And sigh for the horse-radish stenches
We now know so well.

In the words of the old song, I dunno' w'ere I am. I feel that the only way out is to manufacture a new—the eleventh—model for myself.

Major C.] Nevertheless, these ten models fall, roughly speaking, into two groups. One group is personal, original and sometimes bizarre. The other group is official, regulation and staid. Each of the former group is

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an entity: each of the latter is a modification of one pattern. For the moment, why not ignore the first group and see what can be done by picking out, and consolidating, the best things in the second group?

Capt. F.-F.] I suggest that the factors which influence the object stand out very clearly. It seems to me that the three most important are :—

7

(i) Probability of heavy casualties.
(ii) Indeterminate plan of defence.
(iii) Geographical aspect of the country.

I cannot attribute the same importance to many other factors which we might mention in addition to those.

Major C.] Money for nothing, F.-F.: it's too easy.

8 Lt.-Col. P.] What about a review of the situation from a medical point of view, involving many aspects of medical activity, mainly administrative?

Major C.] In fact, very much in the form of a Reconnaissance Report?

Lt.-Col. P.] Precisely.

Col. M.] Do that, and you are very apt to produce a hotch-potch of Object, Considerations and Plan. If you are told to write an appreciation, you have no authority for dispensing a mixture.

Try again, F.-F.

Capt. F.-F.] How will this do, sir?

11

(1) Conditions affecting the health of the troops.
(2) (*a*) Sick.
(*b*) Wounded.
(3) Collection and evacuation of sick and wounded.
(4) Accommodation.
(5) Recommendations—with separate Append—

Col. M.] Another scatter-gun prescription. No clear dividing line between Considerations and Plan. Why do I insist on a scrupulous

1 observance of regulations? Because these very regulations say: "To ensure mutual confidence and unity of action, all training must be conducted on uniform lines." You cannot ignore that.

Lt.-Col. P.] If I may say so, sir—a somewhat cramping doctrine.

Col. M.] I do not propose to re-open the debate on that point, Pondicherry. In any case, you would come off second best: you did last time.

Major C.] Hear, hear, sir!

Col. M.] Never mind the approbation, Crookham. What is your model?

9 Major C.] It is a hybrid, sir. First of all I studied page 150 of R.A.M.C. Training. Then I concentrated on a couple of the more formal, regulation patterns, and from them I compiled this :—

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2 and 10

(2) CONSIDERATIONS WHICH AFFECT THE ATTAINMENT OF THIS OBJECT.

(*a*) *Factors relating to climate.*
(*b*) *Factors relating to disease.*
(*c*) *Factors relating to food and water.*
(*d*) *Number and nature of casualties:* (1) *Possible wounded.* (2) *Probable sick.*
(*e*) *Positions and degree of mobility of field medical units.*
(*f*) *Facters influencing*: (1) *Collection of casualties.* (2) *Accommodation of casualties.* (3) *Treatment of casualties.* (4) *Evacuation of casualties.*
(*g*) *Factors of Supply such as extra Medical or Ordnance Equipment and stores.*
(*h*) *Liaison and communications.*

Lt.-Col. P.] I say! That is rather a tall order, isn't it? What about your half sheet of Admiralty notepaper now?

Major C.] That's all right, sir. I have merely aimed at the construction of a framework, designed to carry all possible contingencies. It is not at all likely that, in dealing with a particular Special Idea, the whole framework will come into the picture. You have only to cut out those features you don't want.

Lt.-Col. P.] Yes; and balance the loss by inserting new ones you suddenly think of and must have, eh?

Col. M.] The proof of the pudding is in the eating of it. Let us test Crookham's assertions and Colonel Pondicherry's objections here and now. Turn to the Special Idea: now F.-F., what about climate factors?

Capt. F.-F.] Cut them, sir.

Lt.-Col. P.] Good heavens, F.-F.! With hail and rain and the temperature down to—

Col. M.] You must remember that, at this time of the year, the climate in enemy territory is the same as at home—where the G.O.C has served for the past thirty years. He and his staff know all about these climate factors and their potentialities. The point is this: *As medical men,* can we say that climatic conditions contain factors which will affect the attainment of the object, and from which the General will be able to make useful deductions?

Capt. F.-F.] In this particular case—no, sir.

Major C.] That, sir, is also my opinion.

Lt.-Col. P.] Then I appeal to 1914-15. Is it possible that Trench Foot has been forgotten?

Col. M.] By no means; but position warfare must be regarded merely as a prelude to the decisive operations which will take place when the time is ripe for attack, for only by defeat in the open can an enemy finally be conquered. 13

The first principle of war organization is therefore mobility.

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I apologise for the digression, gentlemen. What have you to say about disease factors, Crookham?

Major C.] We seem to be in for a real dog-fight, sir; but the Special Idea has an air of optimism: it looks as if we shall enter enemy territory on Z + 2 or 3 days. Hence I think we should concentrate on the typhus danger. It is a danger which may profoundly affect the attainment of the object. It is a consideration bristling with important deductions. And, in the meantime, let all other disease factors go by the board.

Omnes.] Agreed.

3 Col. M.] Next—food and water. Pondicherry, if you please; and better say too little than too much.

Lt.-Col. P.] The early stages of the war. Occidental conditions. R.A.S.C. functioning well. No troops from overseas. Chlorination to the extent of over-chlorination: why, sir, my early morning cup of tea is absolutely da——

Col. M.] Yes, yes, but——

Lt.-Col. P.] Cut food and water, sir.

Omnes.] Hear, hear!

Col. M.] Excellent: now for casualties. You will observe that "G" begins his estimate with the helpful announcement that "Battle casualties are not likely to exceed etc." Working on this estimate, I calculate that, on Z day, we shall have to deal with about 300 wounded; on Z + 1 about 200; and on Z + 2 about 100. Sick on a 0·5 per cent. basis. These rough figures provide us with the essentials of this particular consideration. Detailed calculations, tables and so forth will be relegated to an appropriate appendix.

Nature of casualties? No: I do not think it will be necessary to say much about that. True, the enemy is comparatively weak in machine-guns and artillery, but that, in terms of g.s.w.'s, is not likely to interest the G.O.C.

1 Capt. F.-F.] The Special Idea warns us that the enemy may use gas. You will find it under "Intelligence," sir.

Col. M.] I had overlooked that. In dealing with the nature of casualties we must mention it, briefly. By the way, Crookham, are possible gas casualties included in "G's" estimate?

Major C.] I'm afraid I don't know, sir.

Col. M.] Then as soon as our conference is over, run round to H.Q.

13 and find out. Time is often saved and misunderstanding obviated by personal interviews between the representatives of the various branches of the staff.

Lt.-Col. P.] Talking of the nature of casualties, what about classification into the usual "walking," "sitting" and "lying" groups, Colonel?

Col. M.] I'm glad you mentioned that. It is a debatable point; but I think that this classification belongs to estimation, and not to nature, of casualties. Also, that it should be placed in the appendix. You all agree?

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Good! And now, gentlemen, let us tackle the next consideration, which deals with the position and mobility of our units.

Has anyone anything to say about mobility?

Capt. F.-F.] It seems silly to talk about my Thresh, sir. All the same, if this typhus yarn be true, the Thresh may be wanted urgently on Z + 4 or 5. At present it is in Corps M.T. workshop, thirty miles away; and I am told that the engine trouble is serious: that the outfit may not be ready for the road again in under ten to twelve days. So, sir, the Thresh is immobile.

Col. M.] Crookham, you must get busy about that. Make a note of it now. It is a thing of administration—not of appreciation.

Lt.-Col. P.] Still it would be amusing to see the General trying to weigh up the respective merits and demerits of a derelict Thresh and a Serbian barrel.

Col. M.] Although it is essential that the Staff should understand thoroughly the working of the Services, the heads and representatives of Services are responsible for the provision of the requirements of the troops. 13
At the risk of taking you too seriously, Pondicherry, I merely wish to emphasize that the provision of an efficient, mobile disinfector is a requirement, and not a consideration which affects the attainment of the object. There is a type of mind which could not possibly resist a discussion on "The Thresh *versus* the Serbian barrel," even in an appreciation: it is the discursive, airily inventive type.

Never forget the fact that a summary, if short enough, is fatal to any 6
work of imagination.

Lt.-Col. P.] Then you do not agree that an appreciation should state where stores (such as Serbian barrels) are to be found, or contain similar information of use in answering the numerous questions asked by the 15
General Officer Commanding?

Col. M.] "Stores"? "Numerous questions"? I do think that old horse has been sufficiently flogged already, Pondicherry. Let us pass on to the positions of the field medical units.

Major C.] Linking mobility with position introduces the factor of time and space—an essential consideration in practically every military 1
appreciation.

Capt. F.-F.] In that, do you include every military-medical appreciation?

Major C.] Yes, I suppose so.

Capt. F.-F.] Well, in this case I fail to see the necessity. Nos. 32 and 33 Fd. Ambs. are closed, mobile and conveniently placed—like a couple of well-organized fire brigades; while—

Lt.-Col. P.] While No. 34 Field Ambulance—my Fld. Amb.—is acting as Cinderella in the country. Half my personnel are with Casualty Clearing Stations. These units, excellent and efficient though they are, 16
rank without doubt as the spoiled children of the R.A.M.C.

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Col. M.] It is so; but I have been unable to resist the constant demands made by Corps to detail officers and nursing orderlies from the Ambs. for the purpose of assisting the C.C.Ss.; and it is frequently only with the greatest difficulty, and at the eleventh hour before a battle, that these parties can be recovered for their legitimate work with their units behind the front line.

Lt.-Col. P.] And I would remind you, sir, that, in addition to this, the unit which I command has had the honour of acting in turns as a Corps Convalescent Depôt, as a Divisional Rest Camp, a Skin Centre, a Bath and Laundry Establishment, and—if my recollection is not at fault—at present as a Refugee Quarantine Station and Soup Kitchen.

Col. M.] Ha, Colonel, quite true: the exigencies of the Service, you know.

Lt.-Col. P.] And all within a month, sir. I make no complaints; but the factor of time and space is now beyond my powers of computation. In short, sir, what am I, where am I and when shall I be myself again?

Col. M.] Crookham, some of these points, divested of the picturesque, must be appreciated: cut out Cinderella, and underline the eleventh hour.

Capt. F.-F.] Hear, hear, sir!

Col. M.] Now for the factors associated with casualties. Firstly—collection. Tell us about the reconnaissance you made, F.-F.

Capt. F.-F.] This morning Major Crookham and I were up good and early, sir. I took the right sector and he took the left. On the right the ground is exposed, the surface is difficult and the roads are very bad. Hand carriage of casualties is likely to be lengthy and hazardous.

Col. M.] From which you deduce that—?

Capt. F.-F.] Extra bearers may be required.

Lt.-Col. P] Extra-bearers? Huh! This is just the sort of country
16 which breeds our usual chronic, outstanding grouse. Where the medical officers of the battalions in the line absolutely illegitimately and backed as a rule by their commanding officers—sometimes even by the G.O.C. himself when he has been "got at"—try during a push to use the ambulance stretcher-bearers in front of the regimental aid-posts to eke out their regimental stretcher-bearers, with a resulting check to the rapid evacuation of casualties.

Extra bearers? Pooh!

17 Col. M.] There may be need for extra bearers, to supplement the field ambulance bearers, on occasions. They were frequently required in the War, but not so likely in mobile warfare. On reading our appreciation the G.O.C. will note that the reserve units will have to be called upon to provide, if necessary. But within the battalion the battalion provides.

Lt.-Col. P.] Whereabouts is this right sector, F.-F.?

Capt. F.-F.] Square Q 32, Colonel.

Lt.-Col. P.] Round about the second "i" of "RICINI" I presume?

Col. M.] Bless my soul, Pondicherry! How often have I told you to

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destroy that mouldy old map of yours—to destroy it utterly, by burning, sir? Some day, soon, it will land you, and all of us, in trouble. Where is your gridded map?

Lt.-Col. P.] Left it behind: can't abide the sight of it, Colonel.

Col. M.] The policy of the War Office is, broadly speaking, to use 12
gridded maps for military operations: and the intention is that, when they are used, maps of all scales of a given area shall be gridded conformably, so that the same reference shall denote the same point on any map.

For your information and necessary action, Pondicherry.

Left sector, Crookham.

Major C.] Here the surface is good, cover is excellent and much of the ground is dead. Collection and evacuation should be easy, especially as the motor ambulances will be able to get well forward, aeroplanes permitting.

However, there is one snag: the Glauber River. It will not be fordable by bearers with loaded stretchers. "G" tells me it is intended to throw a bridge across at P 1234; but this bridge is primarily for the use of the tanks and other A.F.V.'s. It will be difficult to decide whether the A.D.S. should be located on the proximal or distal side of this bridge.

Col. M.] Sufficient unto the day is the evil thereof. You may lay out
in your mind's eye where you think of having the A.D.S.; but the situation 18
moves too quickly for an A.D.M.S. to attempt to tie down an O.C. field ambulance to a spot site. Incidentally, one word of warning with regard to orders: I have been asked by the staff before an encounter battle in open warfare to site the position of A.D.S.'s, and I have refused to do so, pointing out that the O.C. field ambulance is the man to do that and to notify me his map reference.

Capt. F.-F.] Hear, hear, sir!

Col. M.] M.D.S., Pondicherry?

Lt.-Col. P.] I carried out your instructions, sir, and found that there were several considerations affecting the attainment of the object. For instance, one good site is an advanced landing ground, another is an ammunition dump, and the third is a Tank Battalion headquarters. Also, I was unable to find a secondary path of evacuation, since all the roads seem to be chock-a-block with guns, ammunition or supplies.

Col. M.] Well, the primary object is to win the battle, and everything must give way to the military situation. Do not be depressed if the staff at once inform you that certain places you have arranged for have been previously ear-marked for gun positions, etc., and your work has to be done over again. Meanwhile, before the appreciation is written out, these difficulties will have to be considered, Crookham.

Major C.] Yes, sir: I'll see "A.-Q." Co-ordination of medical
arrangements with the rest of the plan is the duty of the staff. 17

Capt. F.-F.] And A.D.M.S. must be kept informed of the progress of operations so that his medical arrangements may keep pace with the tactical situation.

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Col. M.] Quite so: the medical plan cannot be made without full knowledge of the commander's intentions. A.D.M.S. must therefore be fully informed as early as possible. To ensure secrecy, restrictions may, if necessary, be put on what he may tell his subordinates.

Lt.-Col. P.] H'm. It is comforting to observe that you are all so happy about it—ahem! One wishes to avoid at all costs, anything which
19 might be construed as recrimination, but there is no doubt that much unnecessary trouble and risks of "incidents" would be avoided if junior officers knew more about the medical service, and particularly how dependent it is in the field on exact information.

In my opinion, the fact that Brevet Lieutenant-Colonel Smith, our "A. and Q.", is not *p.s.c.* and is only 26 years of age, is a consideration which affects the attainment of the object.

20 Col. M.] It seems next to impossible to reduce the medical and the other services of an army in the field to a common denominator. But, Pondicherry, your misgivings regarding Smith will be brought down to reasonable proportions if you will cultivate the broad view, and be on guard against the fact that the mind of the medical man tends towards limitation of the perspective, because he is dealing with a subject that requires to be split up into special partitions, and he is never taught to cultivate the wide view of things.

Lt.-Col. P.] Sir, I only complain that Smith's is not wider.

Col. M.] Then we'll leave it at that.

As regards accommodation and treatment, I do not think we need discuss the usual run of casualties here and now. For the moment, let us concentrate on gassed and typhus patients.

18 Major C.] The policy of one special A.D.S. for gassed cases may be possible.

Lt.-Col. P.] Personally I find that they come down with the ruck, and can only be sorted out at the M.D.S.

Col. M.] There I am with you. Your friend Smith will have to enlarge his vision to include suitable accommodation for isolation and treatment of gas casualties—that is, if we appreciate the point properly.

21 Yesterday, the G.O.C.'s preliminary conference dealt almost entirely with "G" matters. But, at a pre-arranged time a second general conference will be held, "A. and Q." presiding. At this conference all services in turn will represent verbally the views they have arrived at as a result of ground reconnaissance, and the staff, considering their views, gives immediate decisions on conflicting claims or any other difficulty that may have arisen.

Capt. F.-F.] That means that the special points regarding the M.D.S. will receive full consideration?

Major C.] Yes; and, sir, I do not think it is commonly realized that ground reconnaissance is of great importance to "A.-Q." and to the services.
13 Time spent in reconnaissance is seldom wasted; and that applies to "MED." just as it does to "G."

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Col. M.] A timely warning, my boy.

Now, as for the typhus problem, I propose to leave that to the hygiene experts, Crookham and F.-F. A short para. in the body of the appreciation, and a special explanatory appendix. The subject is too important to be scamped.

Lt.-Col. P.] An early symptom of typhus is an intense headache. The General is likely to suffer from that before he contracts the disease.

Col. M.] No. The writer should realize that many things which he might take for granted as being part of regular routine will not be so familiar to those who have to read; the account should be clear not only to the writer, but to a reader unacquainted with the special subject matter.

Lt.-Col. P.] Then, Colonel, good-bye to the half-sheet of Admiralty note-paper.

Col. M.] In an appendix, at any rate, brevity (like all other good things) can be overdone. F.S. Regs. stress conciseness and accuracy; but too much insistence on conciseness involves loss of clearness and accuracy. This is especially the case when matter is not written in coherent sentences, but takes the form of disconnected notes. The omission of pronouns, possessive adjectives and prepositions is particularly apt to leave the sense obscure. Thus: "Arrived Citronella 14th. Twenty cases typhus." Not only is this obscure: it is inaccurate. You would ask: "Town or District of Citronella? Were the typhus cases yours or the enemy's? and, if the latter, were they soldiers or civilians?" and so forth.

However, that is by the way: let us get on with supply factors. F.-F.?

Capt. F.-F.] For instance, factors affecting the supply and quantity of extra medical material, such as stretchers, blankets, dressings, splints, etc. The question of extra blankets, stretchers, dressings, etc., for R.A.P.'s will have to be considered; and you may think it necessary to make "dumps" of these articles.

Major C.] If poison gas is used, the field ambulances should each hold extra sets of clothing and pyjamas. Are they obtainable quickly, and in sufficient quantities?

Lt.-Col. P.] Is there a sufficiency of anti-tetanic serum available?

Col. M.] Yes: we are safe on those lines; so now for the last part of this section—the vexed question of liaison and communications. By what factors are these affected?

Capt. F.-F.] Length of cable is one.

Lt.-Col. P.] What?

Capt. F.-F.] The dressing stations, when cable is available, will be connected by telephone with the office of the A.D.M.S. of the division.

Lt.-Col. P.] The awkward pause which followed your pronouncement did not surprise me, F.-F. "*When cable is available*"!

Major C.] It is of great importance that information regarding the situation, as affecting the number of the casualties and the area where they are occurring, should be constantly transmitted between brigade and

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divisional headquarters, in order to enable the A.D.M.S. with a division to regulate the movements of the field ambulances.

Lt.-Col. P.] All very fine and large ; but we are not within the orbit of Signals ; and a gold mohur to a bad rupee that no cable will be available. If you are seeking for a consideration affecting the attainment of the object, verily you have it here.

Col. M.] Signals and cable apart, it is of great importance to remember
19 that information to be of use to a field ambulance commander must, as a rule, come from in front, and he should be able to get all necessary information as soon as he gets into touch with brigade headquarters. Information from the rear is often out of date by the time it is received.

Lt.-Col. P.] No wonder, sir ! Why, when I was at the War ——

Major C.] I apologise for interrupting, Colonel ; but may I say that, if we start an argument on this subject, we shall have to spend over it more time than we can now spare ? Besides, this and allied questions were dealt with in an adequate and reasonable way in the Journal of the
23 Corps, in 1921.

Capt. F.-F.] Yes : and again in 1928.

18 Col. M.] Much has been written about having a liaison officer from the field ambulance with Brigade Headquarters, and there is much to be said for it. Our disabilities in this respect will appear in the appreciation, and our suggested remedy in the plan.

Lt.-Col. P.] But, sir, the G.O.C. will feel aggrieved to find his particular problem used as a peg on which to hang a general grouse.

Col. M.] We must be careful about that, Pondicherry. It is a danger.

Major C.] The G.O.C. is well aware of our liaison-communications grouse, sir. Here we need only state the relevant factors appertaining to
9 the Special Idea now before us ; and state them in such a way that our plan will follow as a matter of course—as a logical deduction.

Capt. F.-F.] Hear, hear !

Col. M.] So be it.

Gentlemen, we have now constructed the framework of what is far and away the most important part of any appreciation. The rest will, or should, build itself. Carry on, F.-F.

1 Capt. F.-F.] Courses open : (1) to our own side, and (2) to the enemy.

I think, sir, this would be comparatively simple were we in possession of the staff's appreciation. Presumably it is not yet written, or is still " Secret." The Special Idea does not help us much.

Col. M.] H'm. I was waiting for that. You know I am supposed to be rather touchy about my standing and prestige ; but I am not touchy
23 without reason. Considering his seniority and responsibilities, the A.D.M.S. should certainly be a member of the " A " mess of the division, and not be relegated to echelon " C " where paymasters, D.A.Ds.O.S. and other secondary satellites are generally to be found. So many important hints are dropped in the G.O.C.'s mess as to future movements, etc., that do not

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filter down into orders for 48 hours or so, that the question as to which mess the A.D.M.S. lives in will materially affect the amount of information he picks up and can—if necessary and advisable—pass on to his F.A. commanders. I have managed to live up to these views, and so I am now able to tell you that our courses will be based on the following courses which are open to 10 Div. :—

(*a*) To make a determined attack now.

(*b*) To make a partial attack with the object of pinning the enemy to his ground, until our reinforcements arrive.

(*c*) To avoid action until our reinforcements arrive.

Capt. F.-F.] I do not see the object of discussing the medical aspects of "(*b*)" and "(*c*)" since, from the Special Idea, it is plain that "(*a*)" has already been chosen.

Lt.-Col. P.] In my opinion, the third heading given in T. and M. Regulations, viz., "Courses open to both sides," has no bearing on the medical appreciation and may be omitted. It is obviously not applicable to our considerations.

Major C.] I am sorry, sir, but that is not obvious to me.

Col. M.] Nor to me.

Lt.-Col. P.] This, at least, is plain—that this heading is not quite suitable for a medical appreciation, unless we regard disease as the enemy. In this case it would be a good place in which to discuss the probable effect of occupying a locality which for one reason or another is likely to cause an increased wastage of men by disease. I am, of course, thinking now of typhus.

Col. M.] Yes : and you are also thinking in terms of Medicine. True, it is by our professional merits that we stand or fall. Even cardinal military sins, should they appear, are readily condoned in the presence of professional genius. Your thought of typhus at this juncture may not be a cardinal military sin, but nevertheless it is out of place, despite your good intentions as a sanitarian.

Major C.] To revert to the word "obvious," sir, it really is curious that a thing which seems obvious to one person is not at all obvious to another. Thus, at this point, the only thing which appears obvious to me is a section based on the Special Idea, and constructed something like this :—

(3) Courses Open to the Two Sides.

(*a*) *A statement of the different courses of action open to the medical service and field medical units,* 10 *Div., but not including the course described under* "(iv.) *Plan.*"

(*b*) *A similar statement, or note, of the different courses open to the enemy, when such courses might affect our own dispositions and functions.*

Col. M.] Thank you : I accept that.

Lt.-Col. P.] So far as our own side is concerned, sir, what is the use

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of discussing a number of possibilities which, in the very choice of a definite plan, you have already rejected?

Major C.] But, sir, the choice has only been made after the possibilities have been examined; and it has been made for us, as you may gather from the Special Idea.

Lt.-Col. P.] Quite so, Crookham—exactly what I am trying to drive into your abnormally thick skull. Why, then, consider the remaining courses at all?

Col. M.] Let me put it to you in this way, Pondicherry. As I was leaving the mess—"A" mess—this morning, the Corps Commander arrived. After the usual greetings, he said to me: "Well, Millbank, all ready for Z day?" I answered: "Almost, sir. It's going to be a big job: an 'All-Hands' Parade,' so far as I can gather." "Very likely, very likely; but don't be too sure about it—not just yet, Millbank," said he, "it's a great mistake to put all your eggs into one basket, you know."

Lt.-Col. P.] Phew!

Col. M.] That's Corps. This afternoon we may be told merely to hold. Then there is Army. To-morrow we may be ordered to stand fast pending the arrival of reinforcements: who knows?.

Lt.-Col. P.] In short, order, counter-order, disorder.

Col. M.] Oh—come, come! we have not yet been given any orders; and not every Special Idea will indicate the proposed course as clearly as this one does.

Major C.] Besides, if we examine the courses open to the two sides from the medical point of view, we shall be ready to pursue any course of action when the orders do arrive: we shall not be caught out by some unforeseen demand.

Capt. F.-F.] From our own side, I follow that. From the enemy's, I am in doubt, and the Special Idea does little to clear up the fog of war.

Col. M.] Here, again, my after-dinner port—one glass only, these days, 'pon my soul—has held more information than alcohol. I understand that the courses open to the enemy are—

(*a*) To stand and fight.
(*b*) To retire by deliberate bounds.
(*c*) To effect a sudden and complete withdrawal under the protection of a thin, delaying screen.

But, unfortunately, all this is surmise; and, as the Special Idea says, intelligence is scanty and by no means reliable.

Capt. F.-F.] Still, sir, what you tell us is of importance from the medical point of view. Course "(*a*)" has, for us, a very different meaning from course "(*c*)."

Lt.-Col. P.] *Very different*, my boy.

Do you know which course is likely to be adopted, Colonel?

13 Col. M.] No; and nobody can say. War is a contest between the will of the opposing commanders. Given reasonably equal conditions, success

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will be attained by the commander who possesses a greater degree of that indomitable resolution and energy which enables the decision, once made, to be carried through. In view of this, it is not surprising that our G.O.C. proposes to make a serious attack, and that we believe he will be successful therein.

Lt.-Col. P.] The old man on the other side, General Salvarsan, may not possess a strong and resolute will or a ready acceptance of responsibility, but he is credited with a great capacity for slimness; and, whether in attack or defence, the first thought of a commander must be to outwit his adversary.

Major C.] Which reminds me, sir, that this morning the much-maligned Smith hinted that the whereabouts and intentions of the enemy mechanized-armoured formation are unknown. Smith seemed to be rather worried about it.

Lt.-Col. P.] Merciful heaven, Crookham! by this time 34 Field Ambulance may be eaten alive!

Col. M.] I think that, by now, we are all duly impressed with the necessity of studying the courses open to the enemy; and I notice that Colonel Pondicherry is anxious to return to his unit as soon as possible. Let us proceed to consider the fourth, and last, section—the plan.

Lt.-Col. P.] The plan of this appreciation will be the system of evacuation recommended. 8

Capt. F.-F.] By Jove, sir! and what about all sanitary and hygienic measures to be taken to preserve health, e.g., recommendations regarding water supply, its purification and safeguarding, also supplies which may be procured locally, such as milk, fruit and vegetables; and special measures recommended for disposal of excreta, refuse, etc., and special precautions necessary to prevent contamination of food by flies; precautions to be taken to combat prevalent diseases; recommendations regarding washing and disinfection of clothing, etc.? 10

Major C.] Not forgetting the examination of the mess waiters' stools for dysentery——

Lt.-Col. P.] and the inspection of the A.D.C.'s shirt for——

Col. M.] F.-F. . . . I have listened to you more in sorrow than in anger. Put yourself in the G.O.C.'s place. I suggest that what he wants to know should be the first thing to meet his eye. 8

Lt.-Col. P.] Of course, sir. You mean——

(*a*) Whether the medical resources available will be able to meet successfully, as they stand, the operations in view.

(*b*) If there are weak links in the chain, what are they?

(*c*) What extra transportation facilities, hospital accommodation, medical personnel and equipment will be necessary to make the weak links strong?

(*d*) In general terms, how is it suggested the medical services be organized and located for the operations in view.

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Major C.] With, in addition——(*e*) A recipe for the preparation of Eusol on the field of battle and——

Capt. F.-F.] (*f*) A glossary of colloquial terms for use in dealing with refugees and ps.o.w.

Col. M.] Except for your afterthought, your paragraph "(*d*)"—confound you, Pondicherry! and why—"In general terms"? To the devil with your general terms: this is a plan—A PLAN—sir.

Gentlemen, is it not possible to remember that we are dealing with a numbered and dated Special Idea—at present, for us, *the* Special Idea? And, secondly, is it not possible to remember that, if the appreciation is built accordingly, separate appendices can be attached in logical order, and can be referred to the reader, by the writer, if and when necessary?

Major C.] How will this do, sir?

2 (4) PLAN (CONFINED TO SPECIAL MEASURES REQUIRED BY THE SITUATION).

(*a*) *Recommendations for the prevention of disease.*

(*b*) *A scheme for the collection and evacuation of casualties from sickness and wounds following an estimate of the number of casualties under each head.*

Capt. F.-F.] "(*b*)" might well be represented in sketch or diagram form.

Col. M.] I am glad to observe that you have recovered your sanity, F.-F.

Major C.] My view is that, in the plan, you should state exactly what
4 you intend to do.

Col. M.] Quite so. The appreciation having been written, what does the G.O.C. do with it? He will probably turn to the last page, and if he agrees with the plan he will pass it to his staff to arrange for it to be carried out. He may possibly read the rest to see how you have arrived at your decision, he certainly will do so should there appear to be any difficulty about carrying out your suggestions or if they do not fit in with his own battle plans, then if he decides your plan is satisfactory and there is no other alternative, the staff will issue the necessary orders. You will probably be called in to discuss matters with a view to modification of minor details.

A realization of what is done with an appreciation in actual practice will, I think, help officers in understanding what is really wanted.

Major C.] Your remarks, sir, support the advice given to the effect
12 that, when an appreciation is finished, you should go through it in the reverse order, i.e., from plan to object. This brings out vividly all that the appreciation involves.

Col. M.] Yes, I have always found that a useful tip, and especially in checking the logical sequence and reasoned deduction of the thing.

1 By the way, Crookham, don't forget the heading. State what the
and situation is, from whose point of view it is being appreciated, and for whom
2 it is intended; and insert place, time and date.

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That is all, gentlemen. I am grateful for your valuable help and intelligent co-operation. Here's——

Lt.-Col. P.] Sir, before we disperse I should like to say that I do think the appreciation should commence with a short description of the force to which you are attached. The strength of the Division and its medical personnel can be extracted from War Establishments; but to facilitate this part of the work, tables can be inserted at the end of the paragraph showing the strength of the Division, and the personnel of its various field medical units. After the strengths have been stated, the appreciation should fully show——

Col. M.] As I was about to say——here's to our next merry meeting. *On les aura!*

All salute.

Major Cuthbert Crookham, D.A.D.M.S., takes a fair sheet of foolscap and writes: "APPRECIATION. . . .

Captain F. Frensham-Fleet begins to draw the ground plan of his sketch-diagram.

Lt.-Colonel Percy Pondicherry hesitates between the box seat of his Junior Mostyn-Orris and the glass-panelled doorway of "La Belle Flamande." He chooses the latter, and orders a "dunkler." Two officers, both bearing the badge of Aesculapius, are sitting at a neighbouring marble-topped table. One is wearing kharki, the other blue. Their conversation fills the sparsely occupied rooms.

Kharki.] "It is, naturally, medical brass hats with whom I am chiefly concerned. Starting *la vie militaire* as an innocent-minded and peaceful civilian, one has to learn as quickly as possible the noble art of 'getting one's own back,' or perhaps more correctly of 'not being left'; outlooks have to be changed and standards of values readjusted. I do not wield the two-handed battle-axe of Philip Gibbs and his clan in dealing with these people: I consider the class, as a class, much maligned. But there are, *sans doute*, some extraordinary individuals amongst them, and one has, on occasion, to fight with wild beasts at Ephesus."

Blue.] "Oui: du commencement tous font la guerre. Alors pourquoi maintenir la distinction entre soldats de la réserve et soldats de l'active? Ah, oui, sur le papier, dans les discours, c'étaient les citoyens unis pour la défense du pays, c'était la nation armée. Mais quand il s'agissait d'en-venir aux faits, c'est-à-dire aux honneurs, à l'avancement, aux soldes, la division reparaissait. Les balles, les obus et les gaz ont-ils fait un choix entre ceux de la réserve et ceux de l'active?"

Lt.-Colonel Pondicherry pinches himself, drains his glass in one long draught and departs. "Well, yes, come to think of it," he says to himself, "there is a mighty big difference between an appreciation and a brass plate."

Meanwhile, Colonel Sir Marmaduke Millbank is perusing a note which

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he has just received. This is what he reads: "Secret. Med. Enemy A.F.Vs. appeared near Tragacanth, R 75, No. 34 Fd. Amb. in imminent danger of capture. Chief wishes to see you at once. 'A.'"

Major Crookham looks up from his work. "The appreciation makes good progress," says he, "but I feel I am being defeated by Section (iii) (b)——Courses of Action Open to the Enemy. Perhaps you would like to tackle that, sir?"

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THE KAHN TEST IN INDIA.

By Major ALEXANDER HOOD, M.B.,
Royal Army Medical Corps,
AND
Assistant Surgeon C. S. TAYLOR,
Indian Medical Department.

The Kahn test is a flocculation test used in the serum diagnosis of syphilis. In December, 1925, this test was adopted by the United States Navy as the official sero-diagnostic method in syphilis in place of the Wassermann reaction. Winder and Michael (1926) have reported favourably on the use of the test in India, but since their work was done certain improvements have been made in the test. Greval (1929) has also used the test in India ; his report, however, is much less favourable.

There is now a vast literature, mostly from America, in favour of the Kahn test. Osmond (1928) in England has written extolling it.

It has to be remembered that any new sero-diagnostic method for syphilis is generally compared with the Wassermann reaction. This is perhaps inevitable but has certain disadvantages; the Wassermann reaction is not a definite immunity reaction and new methods have therefore to be compared with an empirical standard. It would be interesting to speculate on what would have been the attitude of serologists had the order of appearance of the Wassermann and Kahn tests been reversed and the Kahn been the criterion of the value of the Wassermann. How many would have adopted the Wassermann ?

The adoption of a simpler test than the Wassermann would be welcomed by every military laboratory worker, and if it could be shown that any simpler test is as efficient in diagnosis and as a guide to treatment then a very strong case for its adoption would be furnished.

It should also be realized that while the Wassermann test in the hands of the expert who is performing the test regularly, who has a perfect laboratory and competent assistants, will produce regular and reliable results, it is not so likely that such a complicated test will be reliable in the hands of those who only perform the test for a period of one to three years after an interval of several years. Moreover it should be observed that there is no unanimity amongst the experts of different countries regarding the best method of performing the Wassermann reaction. At the second laboratory conference on the sero-diagnosis of syphilis (1928) no fewer than seven new methods were shown by the various participants in the conference.

One of the resolutions adopted at the conference was as follows :—

"And is of opinion that the best of them (i.e., flocculation tests) may

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be regarded as equal in value to the best of these which depend on fixation of complement."

"It desires nevertheless to emphasize the fact that no less than the complement fixation tests these flocculation methods are, despite their apparent simplicity, extremely sensitive to the slightest differences in experimental conditions and subject to so many sources of error in connection both with the execution of the test and the reading and interpretation of the results that they must be placed only in the hands of specially trained serologists."

The conference also recommended that two different sero-diagnostic methods should be used to get the best results and some members of the conference recommended that one of these methods should be the Bordet-Wassermann test.

The Kahn test may be said to be one of the best, if not the best, flocculation test yet devised and, while it undoubtedly requires careful adherence to detail to get good results, the very fact that it has so few ingredients means that there is less liability to error than in the Wassermann test with its more numerous variables.

It would have been very interesting had the conference answered the following question.

Which test (Kahn or Wassermann) is less liable to error in execution and reading of results in the hands of the ordinary laboratory worker?

It is advisable to adopt for military practice a test which, on account of its simplicity, is likely to give, year in and year out, in spite of changes of climate and personnel, more reliable results than the more complicated Wassermann procedure in similar circumstances. Our results lead us to believe that such a test is found in the Kahn test.

The work upon which this paper is based was commenced by one of us (A. H.) in the Madras District Laboratory, Bangalore, and has been continued in the Southern Command Laboratory, Poona.

The Apparatus and Ingredients of the Test and their Preparation.

A very full account of these and the test will be found in Kahn's book, "The Serum Diagnosis of Syphilis by Precipitation," from which the following is largely taken:—

(*a*) *The ingredients of the test.*

These are three in number.

(1) *The Patient's Serum.*—0·45 cubic centimetre of patient's serum is required. This is a much larger quantity than is required for the Wassermann test, but at least in military practice can scarcely be called a disadvantage. Blood is always taken from a vein and more than one cubic centimetre of clear serum is usually obtained. Before any of the hospitals served by this laboratory knew we were doing the Kahn test it

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was possible to do both Kahn and Wassermann tests on about 95 per cent of the sera sent for the Wassermann only. The serum should be free from visible particles, and sepsis does not interfere with the Kahn test to such an extent as it does with the Wassermann test.

(2) *Saline.*—This is a 0·9 per cent solution of chemically pure sodium chloride in distilled water and offers no difficulty in preparation.

(3) *The Antigen.*—We have found it necessary in India to follow a modified method recommended by Kahn in order to obtain an antigen coming up to his standard. Instead of three beef hearts we use eight hearts (cost Rs. 2).

About 200 grammes of muscle are cut from each heart and passed through a mincing machine. The mince is then spread on a glass plate and dried by two electric fans; when sufficiently dry—this takes from six to eight hours—it is turned over, and then left exposed to the fans overnight. In the morning the material is hard and is then ground up in a mortar, a fine powder resulting.

The powdered heart muscle is incubated for four weeks at 37° C. prior to extraction. Incubation from one to three weeks was not found so satisfactory. Following this incubation, extraction is commenced and the various steps are outlined in the table below taken from Kahn's book.

OUTLINE OF METHOD FOR PREPARING ANTIGEN FROM POWDERED BEEF HEART.

Ether extraction	(1) 25 gm. powder in 250 c.c. Erlenmeyer—100 c.c. ether added. Flask shaken 10 minutes to keep powder in suspension. Mixture filtered. Gentle pressure exerted by means of spatula until practically no ether drops from funnel. (2) Moist powder returned to flask—75 c.c. ether added. Mixture shaken 10 minutes and filtered as in (1). (3) Moist powder returned to flask—75 c.c. ether added. Mixture shaken 10 minutes and filtered as in (1). (4) Moist powder returned to flask—75 c.c. ether added. Mixture shaken 10 minutes and filtered as in (1). Powder dried until free from ether odour.
Alcohol extraction	Powder weighed and returned to flask used above (after complete drying). 5 c.c. alcohol (95 per cent) added per gm. of powder. Mixture shaken 10 minutes. Extracted three days at room temperature (21° C.) without shaking. Mixture shaken five minutes before filtration. Filtered extract kept in dark at room temperature as stock solution.
Addition of cholesterin	6 mgm. cholesterin added per cubic centimetre alcoholic extract. Cholesterinized extract filtered. Antigen now ready for titration. (Cholesterin is added to an amount of alcoholic extract sufficient for several months' use.)

An antigen prepared as above was titrated as described later and compared with an antigen prepared and standardized in Kahn's own laboratory and obtained from him direct. The comparison consisted in the putting up of tests with sera giving positive, negative and intermediate reactions

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with Kahn's own preparation of antigen and with our preparation; the results were identical.

A standard antigen could therefore be prepared in India and we have since prepared it in large quantities without difficulty.

Antigens prepared in Poona were sent to Peshawar by ordinary post on June 5, 1929, and arrived back in Poona on June 14; they were not packed specially and no ice was used; they travelled during the middle of the hot weather through Lahore at a period of greater heat than had been experienced for thirty years; they were re-titrated on return and were found unchanged except that one of the less sensitive antigens had become slightly more sensitive. Moreover the antigen supplied to us by Kahn has been in India for eighteen months, kept at room temperature in the dark in Bangalore and Poona, and remains as sensitive as it was on arrival.

The antigen therefore travels well and keeps well in India. Kahn has described other methods of increasing the sensitiveness of the antigen but the above method has always proved satisfactory in our hands.

(*b*) *Apparatus required.*

The test tubes recommended for use measure 7·5 centimetres in length and one centimetre in diameter. We have found that the dilution tubes used in the Dreyer test are, for all practical purposes, about this size and they have been used by us with satisfactory results.

The antigen before use requires dilution with saline and for this purpose tubes 5·5 centimetres in length by 1·5 centimetres in diameter are used, they should have straight sides and flat bottoms. Most laboratories have such tubes in stock.

The pipettes required are :—

0·2 c.c. pipette graduated in 0·001 c.c.
1 c.c. pipette graduated in 0·01 c.c.
10 c.c. pipette graduated in 0·5 c.c.

The racks should be capable of holding three rows of ten test tubes with the middle row off-set to facilitate reading without removal of the tubes; as will be seen later, this offsetting is not essential.

The glassware must be thoroughly clean and neutral—this can be secured in a variety of ways familiar to all laboratory workers.

A water bath regulated to 56° C. is also required.

Practically the whole of the above apparatus is available in every military laboratory in India.

Before tests can be done the antigen has to be titrated as follows:—

Titration of Antigen.

Two rows of five antigen dilution tubes are put up. Into each tube of the back row is pipetted 1 c.c. of the antigen to be titrated. Into the front row saline in amounts of 0·8 c.c., 0·9 c.c., 1·00 c.c., 1·1 c.c. and 1·2 c.c. is pipetted.

The antigen is then diluted with the saline by pouring on to it the

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saline in the tube immediately in front of it and pouring the mixture rapidly backwards and forwards five times. This results in having five tubes containing:—

1 c.c. antigen + 0·8 c.c. saline = A Tube
1 c.c. antigen + 0·9 c.c. saline = B Tube
1 c.c. antigen + 1·0 c.c. saline = C Tube
1 c.c. antigen + 1·1 c.c. saline = D Tube
1 c.c. antigen + 1·2 c.c. saline = E Tube

The dilution must be done rapidly without hesitation.

These tubes are left to stand for half an hour.

A rack is set up containing three rows of five tubes as used in the test proper, labelled A to E.

Into the front row is pipetted 0·05 c.c. of the similarly labelled antigen.

Into the second row 0·025 c.c. and into the third row 0·0125 c.c. appropriate antigen.

To each tube is then added 0·15 c.c. saline, each tube is then well-shaken by hand and the rack shaken for two minutes.

One c.c. of saline is then added to the front row tubes and 0·5 c.c. saline to the other tubes.

The titration figure of the antigen is indicated by the tubes showing no flocculation with the antigen containing the smallest amount of saline. Suppose tubes E and D show no flocculation and C shows flocculation, then tube D indicates the appropriate titration, that is 1·1 c.c., and that antigen when used in the test proper will require to be diluted in the proportion of 1 c.c. antigen to 1·1 c.c. saline.

It should be noted that in reading these results we have found a hand lens essential.

The antigen once titrated remains stable.

Before the test is commenced the serum has to be heated in the water bath at 56° C. for half an hour. Should sera be kept to be tested on future occasions, as for example in the case of control sera, each of these must be heated on the day of the test again in the 56° C. water bath for ten minutes.

The Test Proper.

Three tubes are required for each serum and the test itself is simple.

Each test when set up contains:—

Tube 3	0·0125	c.c. standard antigen dilution
	0·15	c.c. serum
	0·5	c.c. saline
Tube 2	0·025	c.c. standard antigen dilution
	0·15	c.c. serum
	0·5	c.c. saline
Tube 1	0·05	c.c. standard antigen dilution
	0·15	c.c. serum
	1·00	c.c. saline

The antigen is first diluted with the amount of saline indicated by the titration of the antigen.

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To do this the amount of antigen required for the number of tests to be done is estimated (1 c.c. required for every 18 tests is a rough estimation). The amount is measured into one of the antigen tubes, and into another antigen tube the appropriate amount of saline is measured. The saline is rapidly poured on to the antigen and the mixture poured swiftly backwards and forwards into these two tubes five times. It then stands for ten minutes, is shaken and pipetted into the bottom of the tubes.

0·05 c.c. with a 1·0 c.c. pipette into the front row tubes
0·025 c.c. with a 0·2 c.c. pipette into the middle row tubes
0·0125 c.c. with a 0·2 c.c. pipette into the back row tubes

It is convenient to mark the appropriate graduations on these pipettes with grease pencils of different colours. Worker No. 1 prepares and pipettes the antigen and passes the rack to No. 2 Worker who adds the serum.

The serum is arranged in numbered tubes in wooden racks holding ten tubes. The amount to be added to each tube is 0·15 c.c.; this can be done with a 1 c.c. pipette graduated in 0·1 c.c. or, as we have found more convenient, dropped with a dropping pipette. The dropping pipette used for dropping serum in the Wassermann, viz., Starett-Morse, No. 56 gauge, drops 0·022 c.c. of serum per drop so that seven drops measure 0·154 c.c. We have tested the two methods of adding the serum and have found no difference in the results and the dropping method seems to us much simpler. Seven drops of serum are therefore added to each of the three tubes by this dropper. The next step is to mix the antigen and serum thoroughly, and to do this Worker No. 3 shakes each tube individually and then shakes each rack rapidly for two minutes. (Worker No. 3 is merely a shaker.)

Lastly the saline is added. By the time the first racks have passed through the hands of Workers No. 2 and 3, Worker No. 1 can pipette antigen for 60-80 tests and is ready to add the saline, the racks are passed back to him and he adds 1 c.c. of saline to each tube of the front row and 0·5 c.c. saline to each tube of the back two rows with a 10 c.c. pipette graduated in 0·5 c.c.

The tests are then ready for reading.

The only controls required are one set of three tubes corresponding to a test in which 0·15 c.c. saline is used instead of the same amount of serum. Known strong positive, weak positive and negative sera were always set up by us at one time, but there is some difficulty in maintaining a supply of these in sufficient quantities for the Kahn test so that we now only set up the saline control.

Reading the Results.

Much of the discrepancy in results obtained by the Kahn Test is due, we consider, to a faulty method of reading. We are of opinion that a hand lens is essential. We use two lenses, one of approximately six dioptres, the other approximately twelve dioptres. The reading is made by holding the tubes after removal from the racks up to daylight with a dark background; this can be arranged by pasting black paper across the top half of the

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window at which the tests are read or by arranging a blackboard to shut off half of the window ; both these methods have been used by us and the latter is the most satisfactory. The tubes are held in the left hand, elbow on a table, and tilted so as to give a thin layer of fluid to look through with the lens held in the right hand. Every tube is examined thus. The results are recorded as recommended by Kahn.

++++ i.e., complete flocculation with clear fluid.
+++ i.e., almost complete flocculation but with a trace of opacity left in the fluid.
++ i.e., definite flocculi in semi-opaque fluid.
+ i.e., flocculi present but less definite than the last.
− i.e., a completely whitish opaque fluid with no flocculi.

The last result should always be found in the control tubes.

Tubes giving four and three plus results can be read with the naked eye (the other results require a lens), provided the racks have the middle row of tubes offset. We read every tube with the lens and waste no time looking at them in the rack with the naked eye.

Interpretation of the Results.

From a large experience Kahn recommends that the average number of pluses in the three tubes be determined. Sera giving an average of three or four pluses indicates a strong positive, or + + reaction ; an average of two pluses a positive or + reaction ; an average of one plus or fraction is doubtful or ±, and a negative is of course −.

Specificity of the Test.

Apart from Kahn's researches several other workers have reported on the specificity of the test. Mir and Keim (1928) tested the reaction in 106 febrile cases including pneumonia and typhus, the Wassermann (Kolmer method) was done at the same time and both tests gave parallel results, but their conclusions were slightly in favour of the Kahn as its results fluctuated least as a result of the fever.

Now the Wassermann has always been under the suspicion of giving false positives in certain conditions, most notably in malaria ; many eminent serologists hold that this indicates a faulty technique, but by what particular error or errors these false positives are produced we have been unable to obtain any definite information. We have at times with particular batches of antigen obtained strong positives by our Wassermann method (Medical Research Council, method No. 1). We have carefully revised the technique in accordance with the latest published pamphlet on the subject and lately have only had an occasional doubtful result in malaria. We have used the Kahn test in 182 sera from cases of malaria and have never found a positive result except when the Wassermann reaction has also been strongly positive and where syphilis could not be excluded.

Two cases of jaundice gave strong positive Kahn tests on several occasions, they also gave strong positive Wassermann reactions, neither had previous history of syphilis nor, as far as could be found, stigmata of congenital disease.

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Many cases of tuberculosis have been tested but no false positives were found with the Kahn test. To revert once more to the false positives obtained in malaria it should be pointed out that the form I.A.F.M.-1263A which accompanies all sera sent for a Wassermann test in India has a column headed "last attack of malaria" showing that the possibility of false positives being obtained in that disease had to be taken into consideration.

Now even if these false positive Wassermann results in malaria are due to faulty technique, no authority has yet been able to place his finger on the vital error. In consequence workers in malarial countries will unquestionably feel more confidence in a test like the Kahn where such errors, in our experience, do not occur.

Results Obtained.

Table I.—All Cases.

Number of tests	Kahn and Wassermann agree					Disagree	
	Positive	Doubtful	Negative	Total	Percentage	Wassermann + Kahn −	Kahn + Wassermann −
4,254	548	421	3,017	3,986	93·7	98	70

Table II.—Treated Cases of Syphilis included in Table I.

Number of tests	Kahn and Wassermann					
	Agree	Percentage	Minor disagreements	Percentage	Disagree	Percentage
1,522	1,232	80·9	163	10·7	127	8·4

"Minor disagreements" means that the tests differ in degree of positiveness.

Table III.—Results in Treated Cases which Disagree in Table II.

Number	Kahn + Wassermann −	Wassermann + Kahn −
127	92	35

Remarks on these Three Tables.

Table I.—These results are in conformity with those obtained by the majority of workers. Kahn, Kendrick and Landau (1927) report agreement between the two tests in 96·77 per cent. Salamon (1929) reports agreement between Kahn, Wassermann and Meinicke tests of 92·7 per cent.

Table II and Table III show that the Kahn test becomes negative later in treated cases. This is generally interpreted as meaning that the Kahn test is the more sensitive.

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TABLE IV.—CASES DIAGNOSED BY DARK GROUND EXAMINATION, FIRST EXAMINATION OF SERA.

Number of cases	Kahn +	Wassermann +
36	21	18

The Kahn test therefore in this series was again slightly more sensitive, an important point when the diagnostic value of the two tests is in question.

SUMMARY AND CONCLUSIONS.

(1) The Kahn test is a more simple sero-diagnostic test for syphilis than the Wassermann and therefore more suitable for military practice.

(2) The apparatus and ingredients for performing the test are described, including a modification by using a dropper for adding the serum.

(3) The antigen can be prepared in India as described, is stable, and travels well in the hot weather.

(4) The apparatus is cheap and available in all laboratories in India.

(5) The method of reading the results and their interpretation are discussed and the results in over 4,000 cases are tabulated.

(6) The Kahn test appears to us to be simpler, more efficient and more economical (no guinea-pigs, rabbits or sheep required) than the Wassermann reaction.

(7) Results can be obtained more rapidly by the Kahn test (80 tests can be done in one hour and a half).

(8) The Kahn test lends itself to a quantitative procedure which is simple and of great value in treated cases and which it is hoped to deal with in a further communication.

(9) The method of doing the Kahn test with cerebro-spinal fluid is much more complicated, but is we understand being improved. The number of tests done on cerebro-spinal fluids in the Army is relatively very small and should not influence the adoption of the Kahn test.

(10) After an experience of over 4,000 tests we are of opinion that the Kahn test should be taken into use in all military laboratories where the Wassermann test is now done, with a view to its eventual adoption as the standard test in the Army. The pathologist will find it "grateful and comforting."

We have to thank the many officers R.A.M.C. and I.M.S. in the Southern Command, India, who have sent us quantities of sera, and Dr. T. E. Osmond, St. Thomas's Hospital, for his very helpful advice on the subject of the Wassermann in malaria.

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FIVE YEARS IN THE SUDAN.

By Captain T. W. DAVIDSON,
Royal Army Medical Corps.

Having just read in the Corps Journal of October, 1929, "An Officer's Impression of the Sudan," by Benedict, I have been reluctantly stimulated by the indignation of my brother officers to put pen to paper.

I am only one of many who have spent five as good years as I ever wish to spend in the Sudan; yet Benedict, in sarcasm, states that "He has indeed met people who really like the country." He states that it must be admitted that they are men who are wedded to their work, and who are not tempted by the comforts and distractions and "happy fellowships" of mixed society. I admit that the majority of us are bound up in our work, surely not a thing of which to be ashamed, but I have met very few in spite of it who have not been tempted by the distractions of mixed society.

On the other hand, a thing which Benedict does not mention, and with which he possibly does not agree, is that the society of even a beautiful and intellectual woman comes only a very good second to the thrill of being in a winning polo team or of riding your own horse in a flat race or over a point-to-point. The Sudan is probably the only country where the average officer with average intelligence (*vide* Annual Confidential) and no means, is able to do this.

Benedict describes Khartoum as delightful for a bachelor; green lawns, beautiful trees, the Nile, the flowers, but, by the average Defence Force officer who is fortunate enough to be stationed in the provinces, it is described as a hot place, with too many short drinks, and too many late nights. Khartoum is a very pleasant spot at times, but a place to be avoided, at any rate for the first few years, by anyone who really wants to see the best of the country.

It should, of course, be noted that Benedict, serving as he is with the British Army, saw only a small portion of the country, and none of the real out-station life. I feel sure, however, if he had really known something of the country, he would not have made the remark that melancholy and depression of spirits must be diverted by every means. If, instead of reading Boswell's "Life of Johnson," Gibbon's "Rise and Fall," and the classics, he had read such books as Churchill's "River War," Slatin's "Fire and Sword in the Sudan," Cromer's "Egypt," and the Life of Gordon, in Lytton Strachey's "Four Eminent Victorians," he would have had a totally different outlook on the Sudan. Even the bits of history of the R.A.M.C. in the Sudan, which one can unearth from these various books, are full of interest. One of the most outstanding incidents in Churchill's book is that of the saving of the wounded at the battle of

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Omdurman by the late Sir Arthur Sloggett, who was severely wounded when making a gallant dash across the enemy's front in order to obtain reinforcements.

R.A.M.C. officers serving with the British troops in the Sudan can, if they are adaptable, get as good a time as those of the Sudan Defence Force serving in Khartoum. There is as much good sound medical work as in any other station of its size. One unseconded R.A.M.C. officer headed the list of winning jockeys in Khartoum for two seasons. Another was a member of a party which went shooting regularly and got its thousand sand-grouse before the season was half through, and there is tennis, cricket and football for R.A.M.C. officers and other ranks alike.

I should like to give a rough idea of what service with the Sudan Defence Force means, but, not having the leisure, or the basic grey matter to develop the Benedictine intellect, a few notes are all that can be attempted. I can, however, thoroughly recommend it as a really good job for a fairly junior officer, who is keen on his profession; keen on administrative work, and who would like to get the best sport of every variety, without the necessity of private means.

There is a type which is not wanted in the Sudan Defence Force. That is the type which wants to do as little as it can and grouse all day long about an occasional hardship.

A R.A.M.C. officer seconded to the Sudan Defence Force has endless opportunities to indulge in his bent, be it surgery, medicine, pathology, hygiene, administration or any other branch of our profession. He is given a difficult and responsible job of work to do, and is, after he has shown himself capable of the work, left alone to do it. Sport and pleasure march with the most unpleasant of one's jobs, and the attitude of the native mind is a continual and always fresh source of amusement and study. He must indeed be of an abnormal turn of mind who finds that time hangs heavily on his hands.

Sport offers itself in infinite variety. In the Southern provinces almost every kind of big game is found, and the shooting costs the officer and official little more than the energy necessary to follow the game. Excellent fishing is also to be had in the South, and, all over the Sudan, "scatter-gun" shooting is obtainable including wild duck, geese, partridge, snipe, guinea-fowl, sand-grouse, quail and pigeon. In the northern, western and eastern provinces, and also in Khartoum, one's main amusement in spare time is polo and racing, and one has all the interest of buying and training ponies, the latter, to many, giving the greater amusement. Country-breds are cheap and forage is reasonable in price, so that one can easily afford to keep four to six ponies on one's pay. Most other games such as squash, tennis and football are played in all stations.

In the course of one's job, long distances have to be covered and a lot of trekking has to be done. This, according to the type of the country and the time of the year, is done by car, on horseback, on camel or on foot. And

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nothing is more delightful than to get in towards sunset, from a long afternoon's trek, and after a drink and dinner, to sit down, pleasantly tired, in front of a colossal log fire, beneath a brilliant, star-studded African sky. If one is so fortunate as to have brought a gramophone through which one can enjoy the strains of the "Londonderry Air," life is perfect, or almost perfect—there is just one thing missing—the "happy fellowship" of a beautiful and intellectual member of Benedict's "mixed society."

I regret that I cannot agree with Benedict's account of the Sudan, and am sorry that he should have left the country with a wrong impression, but, at the risk of being rude, I cannot resist quoting Rutherford, who says :—

"The habit of generalizing without a basis of acts, and of theorizing on vague impressions, affords an agreeable occupation to one who has acquired it, but little instruction to others."

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Editorial.

ANNUAL REPORT OF THE LISTER INSTITUTE OF PREVENTIVE MEDICINE.

THE governing body view with great regret the retirement of the Director, Sir Charles Martin, and the head of the Biochemical Department, Professor Harden, who will both complete their period of service at the end of this year.

Sir Charles Martin is well known to many officers of the Corps, both for his work in the War and for the hospitality and ready help which he has given to our scientific workers when visiting the Institute.

Professor J. C. G. Ledingham has been appointed to succeed Sir Charles Martin as Director, and Dr. R. Robison is to succeed Professor Harden.

In the Department of Bacteriology, studies on the viruses of vaccinia, variola and fowlpox have been continued. In the last Report mention was made of the visceral lesions accompanying experimental vaccinia in rabbits. The results of Professor Ledingham and Dr. Barratt's recent experiments show that the necrotic lesions in lungs, liver, spleen, etc., were caused by the vaccinia virus alone. There was no evidence of activation of parasitic bacterial infections by the introduction of vaccinia virus. The production of generalized lesions by strains propagated through organs and not by strains of cutaneous or dermal origin raises new problems of adaptation which are now being studied.

Dr. Petrie has successfully immunized a horse with vaccinia and its serum has been proved to have a large content of anti-viral substance. As the serum of convalescent vaccinees has been stated to be beneficial in the treatment of post-vaccinal encephalitis, it is proposed to offer the serum for trial in these cases. The effect of the serum in the treatment of smallpox will also be studied.

The path of spread of the poliomyelitis virus in the experimental animal has been studied by Drs. Fairbrother and Hurst. The theory most in favour was that the virus entering the body by the naso-pharyngeal mucosa or by the intestinal tract reached the central nervous system by the peripheral lymphatics and was then disseminated by the cerebrospinal fluid. The primary lesion was held to be a meningitis, which spread inwards along the vessels of the anterior fissure to affect the anterior horns of the spinal cord. Drs. Fairbrother and Hurst could find no evidence in support of this theory, on the contrary, all the facts and the mode of advance of the lesions and the distribution of the virus after intercerebral inoculation pointed to the axis-cylinders as the chief routes of transmission of the infective agent. Meningitis was never observed in the early phases of the

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disease which began as a primary degeneration of the anterior horn cells, accompanied by foci of interstitial inflammation in the interior of the brain and cord. Whatever the route of inoculation, histologically the disease spread from above downwards, while the first symptoms were nearly always referable to the lumbar cord.

They found that the virus occurs most abundantly in those regions of the nervous system which show the greatest neuronal changes. In the cerebral cortex where the changes are mainly interstitial without destruction of the nerve-cells, the occurrence of the virus is inconstant. After direct inoculation into the parieto-occipital cortex the virus rapidly disappears from the site of injection and can be detected successively in the optic thalamus, brain stem and spinal cord.

The serum of a horse immunized by intramuscular injections with a filtrate of potent poliomyelitis virus was tested by Dr. Fairbrother and found to possess anti-viral properties comparable with convalescent sera. The anti-viral substance seemed to be in the euglobulin fraction of the serum. It is hoped to use this serum for therapeutic trial in man.

In order to determine the rôle played in post-vaccinal encephalitis by the virus of vaccinia, Drs. Hurst and Fairbrother have studied the encephalitis produced by that organism in the monkey and rabbit. They could not excite nervous lesions by intradermal inoculation of ordinary vaccine lymph or neuro-vaccine of monkey or rabbit origin; but intracerebral inoculation of monkey or rabbit neuro-vaccine was effective in both species of animals. The lesions were mainly meningeal with secondary changes in the underlying cortex; they differed entirely from those of post-vaccinal encephalitis, and the characteristic perivascular demyelination of that disease was never reproduced.

Cases of paralysis following anti-rabic treatment have sometimes shown a histological picture resembling that in post-vaccinal encephalitis, and these accidents have been attributed to the injection of foreign brain substance during the treatment. Dr. Hurst inoculated rabbits subcutaneously with guinea-pig, sheep, human or monkey brain. Profound toxic results followed and the animals died from emaciation. A few animals developed paralysis, for which the most careful examination of the brain, spinal cords and peripheral nerves revealed no cause. It was concluded that while paralysis might occur in rabbits so injected, such paralysis could not be brought into relation with the paralysis observed in man, and that the histological picture seen in man could not be reproduced in animals by such means.

Miss R. M. Pitt has cultivated *B. typhosus* in serum containing antibodies for the somatic or O part of the bacterial antigen, and has shown that serum containing the smooth or somatic antibody transforms smooth cultures seeded in it into rough without apparently affecting the flagellar component of the organism. Miss Pitt has so far not succeeded in turning rough *B. typhosus* into smooth.

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In his studies of Salmonella infections in mice, Dr. Schütze has shown that only the O or somatic content of the bacterial vaccine is capable of conferring protection against *S. aertrycke* and *S. enteritidis*; the presence or absence of the H or flagellar antigen in the vaccine is without effect on its prophylactic value. An efficient vaccine may be produced from an alien species so long as the somatic antigen in each is identical. For example, a *paratyphoid* B vaccine will protect against an *aertrycke* infection and typhoid vaccine will protect against a *gaertner* infection.

In spore-bearing anaerobes Dr. Felix has found that the presence of the H antigen coincided with the motility of the organisms as in the aerobic groups. For example, *B. welchii*, which is non-motile, has no H antigen.

Work on passive protection against anaerobic infections by antibacterial (anti-O) sera has been continued by Dr. Muriel Robertson and Dr. Felix. The anti-O serum was found to be strictly specific, affording protection against infection with *V. septique* of the same serological group. This high degree of specificity in the *in vivo* protective action of this O serum was rather a surprise in view of the considerable overlapping of the O antigen established previously in agglutination and complement-fixation tests between the groups. This O immune serum, which is completely devoid of antitoxin content, was tested for protective action against the living culture and found to possess high protective value, although a local gangrene of considerable severity was set up, while the control animals died within sixteen hours of a fulminating gangrene.

Dr. Schütze has shown that it is impossible to obtain on ordinary agar plates discrete single-cell colonies from seedlings of *B. pestis* and species of the genus *Pasteurella* on account of the oxygen sensitivity of these strains. By adding to the agar reducing substances such as blood or sodium sulphite, single cell colonies were obtained.

Dr. V. Korenchevsky has continued his investigations into the male sexual hormones and the interaction between the sexual glands, the thyroid, anterior pituitary and adrenal glands. He has come to the following conclusions: (*a*) The seminiferous cells secrete hormones which stimulate metabolism and the development of the thyroid cells; (*b*) Leydig's cells produce hormones which are necessary for the normal growth and development of the adrenals and the anterior part of the hypophysis; (*c*) hormones stimulating the growth of the generative organs are produced by both the seminiferous and the Leydig cells; (*d*) the development of the generative organs is influenced by the hormones produced by Leydig's cells in co-operation with the anterior portion of the hypophysis and the adrenals, whilst the hormones of the seminiferous cells co-operate with the thyroid gland to produce the same effect.

Dr. Korenchevsky has found in confirmation of Evans' experiments that an extract from the anterior portion of the pituitary gland made in an acid watery solution stimulates the development of the generative organs and the cortical portion of the adrenals, whereas an alkaline watery extract has an opposite effect.

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Dr. T. Lumsden and Miss A. C. Kohn-Speyer have continued their investigations on tumour immunity. They have produced a vaccine effective against rat sarcoma by attenuating the tumour cells *in vitro*. The tissue was reduced to a very fine state of division by means of the Latapie mincing apparatus. The tumour cells were then mixed with an excess of weak formalin (1-2000 of normal saline) and allowed to stand for varying periods before being injected into the normal rats which it was intended to immunize. The best results were obtained when the rats were injected weekly over long periods with tumour cells less and less attenuated. Even with the greatest care only two-thirds of the animals were found to be effectively protected against a test inoculation of virulent tumour cells.

As the Rous sarcoma gives rise to a certain amount of concomitant immunity it was at first not certain whether the immunity was due to auto-vaccination or not. But by implanting in mice mammary carcinoma which never regresses naturally and gives rise to no appreciable concomitant immunity, this point has been settled in favour of the vaccine hypothesis. It was shown that a large proportion of these tumour-bearing mice could be cured and immunized against subsequent test implantation by repeated inoculation of one per cent formalin into the growths. Where implanted tumours are concerned auto-vaccination is a true cure, viz., it causes the disappearance of the existing tumour and it precludes the possibility of recurrence or of metastasis formation.

Dr. Harriette Chick and Miss Roscoe have found that vitamin B_2 is sensitive to high temperatures in the presence of alkali. Half the potency was lost in two hours at 90-100° C., and 75 to 100 per cent after four hours at 123° C. The same results were obtained whether the criterion was promotion of growth or cure of specific skin lesions on an experimental diet deficient only in this vitamin. This result is opposed to the conclusions of Drummond and other workers who consider that vitamin B_2 is stable to the action of alkalis at high temperatures, and believe that yeast contains an additional dietary factor, vitamin B_3, which is heat and alkali-labile. The failure to breed young rats reared to maturity upon diets which contain all the recognized necessary B vitamins and other dietary factors points to the existence of at least one unknown dietary factor which is indispensable for correct nutrition. Miss Chick and her co-workers are occupied in a search for this unknown substance among purified and ordinary foodstuffs.

Dr. Aykroyd is continuing on a large scale his previous work on cereals (wheat, rice, maize, millet and their constituent parts) with the aim of throwing further light on the epidemiology of pellagra. Foods rich in B_2, viz., meat, milk, eggs, and green vegetables have been found most effective in practice for the prevention and cure of this disease. Cereals as a class are, however, poor in this vitamin, but since pellagra occurs almost exclusively amongst maize eaters, and is almost unknown amongst popula-

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tions whose staple food is wheat, rice, or millet, the vitamin B_2 content of milled maize should be found appreciably lower than that of the other milled cereals, if lack of vitamin B_2 is to be accepted as the primary cause of the disease. It seems unlikely that the association of maize with pellagra should be accidental and due to deficiencies in the other constituents of the maize-eater's diet.

Dr. Aykroyd spent the summer of 1929 in Newfoundland and Labrador, and found beri-beri to be fairly common amongst the poorest of the fishermen who in winter and spring live chiefly on a diet very low in vitamin B_1, consisting of white bread, molasses, salt meat and fish. The occurrence of beri-beri on a milled cereal diet other than rice is considered additional evidence in favour of the vitamin-deficiency origin of the disease.

Dr. Margaret Fixen has been investigating the biological value of proteins, and the experimental results seem to suggest that both vitamins B_1 and B_2 are required for an economical use of nitrogen. The effect is, however, an indirect one, for lack of either vitamin causes a loss of appetite, the diminished calorie intake is apparent in about eighteen hours. The previous estimations suffered from the defect that an inadequate supply of vitamins was given, as substances rich in the vitamins contained sufficient nitrogen to vitiate the experiments. In Dr. Fixen's experiments the necessary B vitamin was given as concentrates containing minimal amounts of nitrogen; it is hoped, therefore, to obtain more trustworthy estimations of the biological value of proteins than has hitherto been possible.

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Clinical and other Notes.

THREADWORMS AND PRURITUS ANI.

By Colonel W. P. MACARTHUR, O.B.E., D.S.O.,
Royal Army Medical Corps.

The following letter,[1] addressed to the Editor of the *British Medical Journal*, is republished with his permission :—

Sir,—In some recent correspondence in your columns regarding pruritus ani, I have seen no mention of the threadworm *Enterobius vermicularis*. Many practitioners, in my experience, believe that the threadworm is an unlikely cause of pruritus ani in adults in this country, and that the parasite if present, could hardly be overlooked. Unfortunately, neither of these suppositions is true. In support of this assertion I may mention that at the moment of writing I have under treatment four adults suffering from this distressing complaint, in each instance acquired in England. The symptoms had lasted, before diagnosis, for from a year and a half to eight years, during which periods the sufferers had had repeated examinations, including sigmoidoscopy, and had received treatment from physicians, dermatologists and radiologists, without permanent benefit, and without the cause of the irritation having been discovered. Three of the four had been advised to undergo surgical operation as a last resource.

I submit that in any case of nocturnal pruritus ani the first cause to be excluded is *Enterobius*. For practical purposes it may be taken that an active nocturnal pruritus which is stopped instantly by a rectal injection of strong salt and water, and which remains absent for the rest of the night, is due to threadworms. In cases of long standing, however, more exact diagnostic methods are available. Eggs may be found in the fæces, but are often absent. They are more readily detected in scrapings from the neighbourhood of the anus. But it is most satisfying to the patient if the parasites themselves are demonstrated. In one instance the suggestion that *Enterobius* might be the responsible agent was not warmly received by the medical attendant, who attributed the trouble to some obvious hæmorrhoids. Accordingly I visited the patient's house after he had retired to bed, and, when the pruritus commenced, a quick local examination with the help of an electric torch resulted in the capture of three female *Enterobius*. Or the worms may be looked for in a returned enema, administered when the irritation is present. A bed-pan or similar receptacle should be employed, because the worms usually sink at once in water and are extremely difficult

[1] *B.M.J.*, June 28, 1930. Correspondence.

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to detect in an ordinary closet pan, especially so as most of the worms passed are contained in the first ounce of fluid returned.

The most important point in treatment is to prevent auto-infection by the mouth, this being the cause of persisting infestation. It is not enough for the patient to wash his hands before meals and after defæcation, as is commonly advised; they must also be scrubbed thoroughly when he wakes in the morning—for the early cigarette and morning cup of tea are particularly dangerous—and again, whenever the skin of the body, or any article of underclothing, has been touched. I have recovered fragments of a worm and several dozen eggs from a single finger nail, and have found a crushed gravid female on an under-garment. Thus it is easy to see how eggs may be smeared all over the surface of the body.

The simplest curative treatment in my experience is rectal injections of salt and water, two tablespoonfuls of kitchen salt to the pint. If this causes griping, reduce the quantity of salt by half, but discomfort after injection is generally due to failure to expel all the air from the apparatus employed. The patient must be taught to give the injections himself, for these are properly effective only when pruritus is felt. An infant's 2-ounce enema bulb is all that is required. The patient lies down with the pelvis raised and injects the fluid; then, without rising, he refills the bulb and repeats the injection once. I have tried giving larger quantities of fluid, and employed more elaborate apparatus, but the results were no better, nor could I find any advantage in giving a preliminary simple enema. When the fluid is passed out the pruritus ceases at once, and the patient feels nothing more until the following night. Sometimes the treatment has the effect of making the worms return to the rectum earlier than usual the next day. Thus, if the nightly irritation previously began between 10 and 11 o'clock, on the day following a wash-out it may be felt about 6 or 7 in the evening. With a little practice the whole process takes only a minute or two, and patients who have been tortured nightly for years will be found extremely grateful for so simple a means of securing undisturbed sleep.

I have obtained cure with a week's treatment; usually, however, the wash-outs have to be continued for about six weeks, but given only when pruritus is felt. Within this period all the developing females should have reached maturity and migrated to the rectum. Infestation persisting for more than six weeks suggests self-infection. I have never had reason to suspect any multiplication of the parasites within the body.

Anthelmintics are helpfnl in reducing the number of worms, but they cannot be relied on to reach those inhabiting the cæcal pouches and appendix. It is suggestive that the drugs usually recommended either have a laxative action themselves or are given combined with purgatives. To one man who had not had a night's unbroken rest for several months, I gave as an experiment one day's treatment with santonin and calomel (santonin 2 gr., calomel ½ gr., t.i.d.). This had a sharp purgative effect

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and the patient remained free from irritation for about a week. The worms expelled were passed alive, suggesting that the calomel was the active agent. Sufferers from an unrecognized threadworm infection often attribute the irritation to constipation, as they have observed that a sharp action of the bowels gives temporary relief.

Sometimes persons in seeking treatment for some late reflex phenomenon due to *Enterobius* omit all mention of pruritus, having been assured that this latter symptom is due to hæmorrhoids, constipation, &c. I have had this experience in the case of patients who, respectively, complained of frequency of micturition, gastric hyperacidity, and passage of large quantities of mucus. The sufferer from the last-named complication, having recently returned from the East, had diagnosed it as dysentery, a supposition supported by the occasional appearance of a trace of blood, which came from excoriations around the anus.

For convenience I have called the anal irritation "pruritus." As a matter of fact, the sensation experienced by the subject of infestation with *Enterobius* is not really an itching, but an intolerable, light, rapid tickling caused by the movements of the worms.

I am, &c.,

W. P. Mac Arthur.

*Royal Army Medical College, S.W.*1.
June 18.

NOTE ON A CASE OF DOUBLE TÆNIA INFESTATION (*T. SOLIUM* AND *T. SAGINATA*).

By Lieutenant G. T. L. ARCHER,
Royal Army Medical Corps.

The patient was an Indian Hospital Corps sweeper of the pariah class (and therefore not bound by the dietetic restrictions observed by higher caste Hindus).

He was admitted to the Indian Section of B.M.H., Wellington, for treatment for tape-worm, having noticed that he was passing segments. After two days on milk diet he was, on October 27, 1929, given 30 min. of ext. filicis liq. at intervals of fifteen minutes for three doses. Two and a half hours later he was given a saline purge.

The resulting two stools were sent to Brigade Laboratory, Wellington, where I examined them and found two heads which, on clearing, proved to be the one a head of *T. saginata* and the other a head of *T. solium*.

Camera lucida drawings were made with an improvised camera lucida.

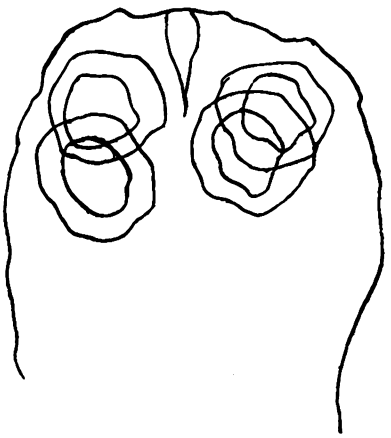
As will be seen, the rostellum was completely retracted in the specimen of *T. saginata*, a small pore being visible where the retraction has occurred.

The possibility of this specimen being in reality a solium which has

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lost its hooklets must be borne in mind, but the different size and shape of the two heads renders it unlikely, as even microscopically they appear to be of different species, also *T. saginata* is by far the more common species found in man in Southern India.

Still, in view of this possibility, it is regretted that sexually mature



Head of *T. saginata.*



Head of *T. solium.*

segments were not stained or treated with carbolic acid, to establish the identity of the specimen beyond a doubt.

I am indebted to Lieutenant-Colonel C. R. Miller, D.S.O., Commanding British Military Hospital, Wellington, for permission to publish these notes.

Echoes of the Past.

THE EGYPTIAN CAMPAIGN OF 1801.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps.

The first year of the nineteenth century was the seventh year of war. By the efforts of Frederick, Duke of York, both the discipline and organization of the Army had improved, and it was now something like an effective force. In his attempts to bring the various departmental services into line, the Duke was faced by the difficulty that they were largely out of his own control. As regards the medical service, the regimental surgeons and their hospitals had always been military, but the general medical staff which had to be found in war time, including the appointment of physicians, staff surgeons, and senior administrative officers, was the business of a Medical Board, who took their instructions from a Secretary of State. Though, by

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a convenient fiction, the medical staff continued for long after to be treated, so far as status and privileges were concerned, as a civil branch of the Army, the whole tendency of the Commander-in-Chief's reforms, culminating in the replacement of the Board by a Director-General in 1809, was to turn them into soldiers.

Advancement in the medical service depended no less than in other branches on personal influence and patronage. Owing partly to the superior professional and social status hitherto allowed the physician as distinguished from the surgeon or the apothecary, and partly to the indolence of the Surgeon General, most of the higher appointments were at the time under the control of Sir Lucas Pepys, the Physician General and President of the Royal College of Physicians of London. It might be difficult to criticize his contention that academic distinction as evidenced by a superior medical degree should be the main qualification for preferment, but his prejudice in favour of the Royal College blinded him to the fact that military and administrative experience, to say nothing of a knowledge of surgery, were equally necessary for an inspector of hospitals. Had he been a man of broader vision or the representative of a united medical profession, it is possible that the medical service of the Army might, whether for better or worse, have secured for itself a more independent position than it did. But the regimental surgeons had already begun to seek the satisfaction which was denied them by their own chiefs, through the patronage of their army commanders, who were not slow to take up the cudgels in the interest of men who had won their confidence. In the controversy that ensued, the Board played a somewhat undignified part, and the establishment of an equable system of promotion which eventually resulted, coincided with their own downfall.

By the year 1800, some of the Commander-in-Chief's designs for the medical services had already become effective. In 1798 a uniform had been prescribed for the general medical staff—a plain scarlet tunic without epaulettes or lapels, a plain round cuff and collar, buttons bearing the King's coronet, white waistcoat and breeches, and a plain cocked hat. A road had lately been opened by which a surgeon could pass to the rank of inspector, through that of deputy-inspector, the last being a new grade for which, despite the protest of the Physician General, staff surgeons as well as physicians, were eligible. A rule made in John Hunter's time that physicians must serve a preliminary period in a lower rank, was enforced, and the direct appointment of civilians to the better paid billets on the general medical staff was now a thing of the past. The eligibility of Scottish graduates for physician's rank, provided they could satisfy a medical board of their competence, was insisted on. The Duke even went the length of giving the appointment to Robert Jackson, after his claims had been rejected by Sir Lucas Pepys on the grounds of insufficient qualification. However ill-advised in the case of a surgeon who had already acquired something of a European reputation, both as an authority on

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tropical diseases and as a great sanitarian, the Physician General was quite possibly within the letter of the law, and the precedent does not seem to have been followed up. Staff surgeons were properly nominated by the Surgeon General, and posted to armies about to take the field, but, once the force was overseas, army commanders usually found opportunity to appoint deserving officers of their own to acting rank. On the whole, though the state of the medical service was as yet far from satisfactory, the prospects of the officer who came in at the bottom, especially while a state of war lasted, had become more favourable than in the past.

As regards medical and sanitary conditions affecting the troops in the field, the provision of medical supplies came within the province of Thomas Keate, the Surgeon General. That they were frequently short or of the wrong kind was not always his fault, but rather that of the King's ministers in ordering secret expeditions for unknown destinations without taking medical or even military advice. Under such circumstances special provision to meet the needs of the campaign or special sanitary precautions were alike impossible. The ships provided by the Board of Transport, and the conditions under which the troops were embarked, were frequent causes of physical inefficiency. Wellesley must have been a pioneer when as battalion commander he ordered daily dumb-bell exercises for his men on board ship; but our generals on the whole seem to have been conspicuous in the attention they gave to their men's health and well-being. Moore, Craufurd, and Beresford had very definite ideas on the art of sanitation as it was then understood. The regulations for the management of sick in regimental hospitals, issued under the Duke of York's authority in 1799, show that the teaching of Pringle, Brocklesby, Home and Monro, had borne fruit. That they were so frequently ineffective was not the fault of the Army but of the political strategists who neglected the soldier's welfare at home and expected him to perform miracles abroad under seasonable and climatic conditions into the nature of which they took no trouble to inquire.

In the transport of the sick by land, the recent formation of a small wagon train for general purposes and under the direct control of the Commander-in-Chief marked a distinct advance. In the last expedition to S. Domingo an attempt had actually been made to form an ambulance corps. Unfortunately, its personnel consisted of the worst and most useless men in the force, and it was a relief to all concerned when drink and yellow fever carried them off. The experiment was not repeated until the outbreak of the Crimean War, when the same mistake was made.

Late in 1800, Sir Ralph Abercromby, who had lately succeeded Sir Charles Stuart as Commander-in-Chief in the Mediterranean, was ordered to embark a force to co-operate with the Turks in attacking the French army left by Napoleon in Egypt. The expeditionary force, having concentrated at Malta, proceeded to Marmorice Bay on the coast of Asia Minor where it arrived at the beginning of the New Year. The troops had

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been employed during the past seven months on various abortive expeditions, and, with rare intervals, had been either at sea or confined on board transports in harbour, from which their health had suffered. The sick were landed and encamped, while the remainder were practised in carrying out an opposed landing. The ships employed for the conveyance of this expedition seem to have been mainly old two-deckers from which the lower deck guns had been removed.

The Principal Medical Officer was at first Dr. James Franck,[1] who had been appointed Inspector of Hospitals in Corsica the previous year, but a senior officer, Inspector Thomas Young,[2] joined the army at Marmorice and took over his duties, Franck remaining with the force. Young's arrival was probably in accordance with Abercromby's instructions, for he had served with him in the West Indies and Holland. The appointment appears to have been contrary to the intentions of the Medical Board. Franck, though a physician of some distinction, was without war experience. Young was a surgeon, who, since he joined as a regimental mate twenty-five years before had been through many campaigns in various parts of the world. Sir Robert Wilson, one of the historians of the war, says that "his philosophical mind well capacitated him for the very important position in which he was placed, and under his direction the hospitals were preserved in the highest order of exceptional arrangement, while the sick were treated with the greatest consideration."

On assuming his duties the new inspector found 1,098 sick with the Army and 798 sick absent at Malta, Minorca, and other places in the Mediterranean. The effectives numbered 16,347. No special medical arrangements had been made for the campaign, and there were no more than three hospital mates to form the nucleus of a General Medical Staff. All available mates were ordered up from the Mediterranean stations, and more were demanded from home. Abercromby, like Lord Wellington, preferred to fill up the more senior medical staff appointments from the ranks of his regimental officers, and Young, who had already incurred the wrath of the Board by returning home one of their nominees from the West Indies, thoroughly agreed with him.

The Fleet arrived off Alexandria on March 1, and, for the next week, it blew so hard that any landing was impossible. The point fixed on was Aboukir Bay, the shores of which were lined with sand-hills held by the French, and partly commanded by the guns of Aboukir Castle. Owing to the shallowness of the water, the ships had to anchor from five to seven

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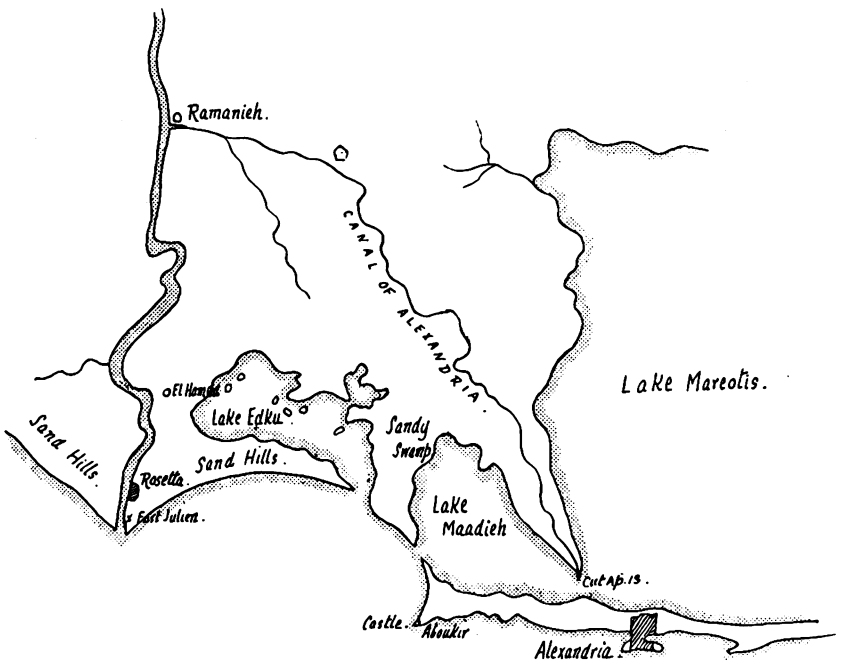
[1] *James Franck, M.D.*, began his army career as physician to the Forces in 1794, and was promoted inspector in 1800. He was a Member of the Royal College of Physicians, Gaulstonian Lecturer 1804, and Censor 1805. He was P.M.O. in Portugal, 1808 to 1811. Died 1843.

[2] *Thomas Young*, hospital mate 1776, surgeon 1778, staff surgeon on the Continent 1793, inspector 1795. He served in S. Christopher (wounded) 1782. West Indies 1795. Holland 1793 to 1794, and 1799. He was retired on full pay 1802 and died 1836.

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miles from land. The attacking force was arranged in three lines, the first 58 flat boats each holding 50 soldiers, the second 84 cutters, and the third 37 launches. The artillery and a small Naval Brigade followed in 14 more launches. The men's knapsacks were left on board. Each man carried a blanket and three days' rations of salt pork, as well as his water bottle.

The medical orders were as follows: "A proportion of the General Medical Staff must be attached in the first instance to each Brigade, and will be allowed such orderlies as are necessary from each brigade. Regimental surgeons are to be allowed one orderly each to carry the field case of instruments. When any wounded are brought down to the beach, and a request shall be made for their being conveyed on board the hospital



ships, the Captain of the division to whom such application shall be made is to direct some of the boats under his orders to perform this service, and, if necessary, that the flat boats shall be removed that the soldiers may be placed with convenience and ease to themselves, directing cutters or other boats to tow them. This service is particularly directed to the attention of Captain Apthorpe, whose division is attached to the Medical Department. After the troops are on shore the stores belonging to the General Hospital are to be landed."

We may apparently assume from this order that certain of the transports were set apart for the reception of the battle casualties at the landing. The definite allocation of a division of boats to the Medical Department is to be noted.

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The order as to the disposal of sick was as follows: "After the troops are landed the sick of such regiments as are embarked on transports are to be collected into one of the vessels occupied by the corps under the care of one assistant surgeon who will as soon as possible report himself and the state of the men under his charge to the Inspector of Hospitals on board H.M.S. 'Niger.' In case of there being only one surgeon present with any regiment in this situation, the duty must be assigned to a careful N.C.O. Regiments embarked on men-of-war will leave their sick under the care of the surgeon of the ship, orderlies to be left where necessary, and to be selected from convalescents. Regiments that have women will employ nurses in lieu of orderly men.[1] The women are positively prohibited from landing until O.C.'s corps have obtained the Commander-in-Chief's express permission."

The disposal of the sick without classification and apparently with inadequate medical attendance seems an unsatisfactory arrangement. There was, however, no certainty as to how the military situation might develop, that hospitals could be established on shore, or even that there would be any water. The point in its favour was that men retained touch with their units, a matter of importance both for discipline and economy, and especially important if the force should be called on to re-embark and put to sea in a hurry.

The landing commenced early on the morning of the 8th. As the boats approached the shore they came under a devastating fire. Two in the front line were sunk, but the sailors pulled steadily on. Upon reaching the beach the soldiers fell in in perfect order, and General John Moore at once led the 40th, 23rd and 28th in line straight on the central sand-hill, which was the key of the position. This was captured in twenty minutes. The enemy maintained a show of resistance for another hour and a half, and, in the meantime, the rest of the troops were brought ashore. The French retired along the narrow neck of land between the sea and the lakes, taking up a position on some high ground a little beyond the western end of Lake Maadieh. The casualties of the British troops during the landing amounted to 30 men killed and 626 wounded, besides 97 casualties among the sailors. The wounded were removed to the ships. The heaviest losses were in the 42nd (Black Watch) and the Coldstream Guards, who were charged by the French Cavalry as they were forming on the beach. The former had 21 killed and 156 wounded. The latter lost their surgeon, George Rose. The regiments were depleted to provide transport, supply, and hospital attendants, reducing the number of men in the ranks to under 12,000.

[1] The regulations for regimental hospitals provided for the employment of "one decent sober woman who shall receive pay at the rate of a shilling a day, whose duty will be to prepare the slops and comforts for the sick, and occasionally assist in administering medicines, cooking the victuals, washing, etc."

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Abercromby advanced two miles along the peninsula, and the Army bivouacked. Contrary to expectation, water was found by digging shallow wells, a piece of good fortune, as for the next two days it blew too hard to land stores. On March 13 the French were driven out of their position with a further loss to ourselves of 179 killed and 1,097 wounded, among the latter being Surgeon Michael Egan of the Camerons. This was the engagement in which the 90th and 92nd regiments earned the battle-honour "Mandora." There were very few horses, and the sand was heavy, but the naval launches were available on Lake Maadieh to bring up supplies and to evacuate the wounded. By this time hospital tents and some palm-leaf shelters had been set up on the beach, but the order for the removal of the sick to the ships had resulted in an embarrassing situation. On March 17 the Inspector of Hospitals wrote home to the Surgeon General that 18 hospital mates had arrived from Portsmouth and 3 from Malta, but that he wanted at least 40 more. A week later he spoke of numbers of sick and wounded in upwards of fifty ships in the Bay and in tents and temporary hospitals on shore, and now needed over 100.

Our men now dug a position about two miles from that of the French covering Alexandria. The cold of the bivouacks, the indifferent water, and the fatigue of bringing up supplies and ammunition by hand from Lake Maadieh—for Lake Mareotis was dry—began to swell the sick list. Tents were set up, including those of the regimental hospitals. The rations consisted of salt pork. On March 21 the French delivered an attack, and a hard and well-fought battle ensued, the numbers on both sides being about equal. The British tents, including those of the sick, were riddled by the French guns, and several of the patients were killed. In the end the enemy were driven off, leaving 1,000 dead and 600 wounded on the ground. Our losses were 243 killed and 1,793 wounded. Among the casualties was Sir Ralph Abercromby, who received a bullet wound in the upper part of the thigh, which was embedded in the bone. Attempts to remove it were unsuccessful, and the gallant old soldier died of gangrene on board ship a week later. His last order was to insist on the return of a soldier's blanket, which had been laid under his head. The Morning State of March 30 showed 12,639 effectives, sick present 3,180, sick absent 1,187. The last figure having been 794 on February 14, the difference apparently represents men evacuated oversea.

General Hely Hutchinson, who succeeded to the command, now left Sir Eyre Coote with 6,000 men to blockade Alexandria, which was further isolated by the admission of the sea to Lake Mareotis. Rosetta was occupied, and the French retired up the Nile. Preparations were made for an advance on Cairo. In Rosetta was found "filth, mosquitos of the most dreadful sort, vermin of every kind, women so ugly that fortunately for Europeans their faces were concealed by a black cloth veil, stench intolerable, and houses almost uninhabitable." General Hospitals were established both here and at Aboukir.

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By this time a contingent from India and the Cape, a cavalry regiment, five British and three Indian infantry battalions under Sir David Baird, had landed on the Red Sea coast, and the army of the Grand Vizier was approaching Cairo across the Eastern Desert. Hutchinson's column consisted of some 5,000 British and Turkish auxiliaries. The men marched, but knapsacks and transport were conveyed by boats. The dust, the flies, and the hot wind from the desert tried the troops sorely, while their single tents gave no adequate protection from the sun. In spite of short marches, 1,122 sick were sent down the river either with fever, dysentery, liver complaints, or ophthalmia. The last practically affected the whole army, though most severe in Coote's command. During the operations 160 men were totally blinded and 200 others lost the sight of one eye. There was no serious opposition from the enemy. On January 21 the column encamped at the point of the Delta where a depot and hospital were formed. The last was in charge of Staff-Surgeon John Webb, who had the title of Inspector of Field Hospitals. A week later a convention was signed, by which Cairo was to be surrendered to the Turks and the garrison sent back to France. In August the army, reinforced from overseas and about 16,000 strong, was back in its old position facing Alexandria.

While these operations were in progress, plague, which had been prevalent in Cairo and Upper Egypt during the year, attacked the troops at Aboukir, and later cases occurred at Rosetta. The immediate source of infection is said to have been the arrival of an infected ship from Smyrna, which came ashore opposite the camp where the hospital was situated and was boarded by some of the soldiers. A cordon of sentries was placed round the hospital tents and quarantine rigorously enforced. The incidence of the disease among the hospital staff was severe. Dr. Findlay, the staff apothecary, Dr. R. Halliday of the 27th Foot, and three hospital mates employed in the wards, died. James Buchan, who had recently joined as Physician to the Forces, volunteered his help, and was shut up with the others. To his skilful treatment and devoted attention the comparatively low mortality was ascribed. John Price, the deputy purveyor, was also mentioned in General Orders for his conduct during the epidemic. According to Colonel David Stewart, both Buchan and Assistant-Surgeon Richard Webster of the 90th had two attacks, from which they recovered. The cases were extremely mild, which Colonel Stewart ascribes to a gradually increasing immunity among those segregated.[1] From April to the end of July there were 318 admissions and 150 deaths. At Rosetta there were sixty-two cases of which twenty-three died. During this period there was only one case among the troops round Alexandria.

It was a pretty general belief that plague in Egypt originated from the corruption of the air by the mud left when the Nile fell. Though quarantine had long been practised, and the contagious nature of the disease was recognized by almost all army surgeons, there were many who held that it

[1] "Sketches of the characteristics, manners, and present state of the Highlands."

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could not be conveyed from man to man. Among the latter was Dr. White, formerly a Naval Surgeon, who was living in Rosetta, and whose opinions seemed to have carried some weight. Whether to prove this point, or to investigate the prophylactic effect of the operation, he rubbed the contents of a plague bubo into the skin of his thighs. As this had no effect, he inoculated himself with his lancet, and, at the second attempt, he died. Dr. Wittman, the Surgeon of the British Mission with the Turks, says that White also tried the experiment of wrapping his Arab servant up in the blanket of a plague patient. The experiment was inconclusive, as the servant ran away.[1]

The Indian contingent arrived too late to take any part in the operations. The bulk of the force came to land at Cosseir, where they were joined by the detachment from the Cape. Elaborate arrangements were necessary for watering the troops in traversing the 100 miles of desert to the Nile at Keneh, which was accomplished in small parties and at night. Water was carried in mussacks on the backs of camels, and leakage caused great trouble. They arrived, however, without mishap and in good health. Three companies of the 86th (2/Royal Ulster Rifles), who had landed at Suez, started on June 6 to march seventy miles to El Hanka, where they arrived on the 8th. They started in the evening with an allowance of three pints of water per man, and halted at 7 a.m., having covered twenty-six miles. The march was renewed at 10, when the thermometer stood at 109°, and men began to drop down. The officers sacrificed their baggage, and employed the camels to carry the sick. Four hours later the temperature was 116° F., and at 4 o'clock a halt was ordered. The mussacks had been cracked by the sun, and the water was thick, but the officers refreshed the men from their small stock of Madeira, and at 7 they pushed on. That night the exhausted column slept for five hours, and marching at 4 a.m. reached the springs of El Hanka at 4 in the afternoon. Seventeen had been left at the last halt of whom nine died, and the rest rode in on the following day.

The instructions issued by Sir David Baird to detachments marching were that in the morning half a pint of wine[2] should be given to each man and a ration of rice which was to be cooked for that day and the next. Canteens were to be filled with *congu*, the water in which the rice had been boiled, and, just before marching, another half pint of wine was to be issued to mix with the congu. These orders bear the impress of James

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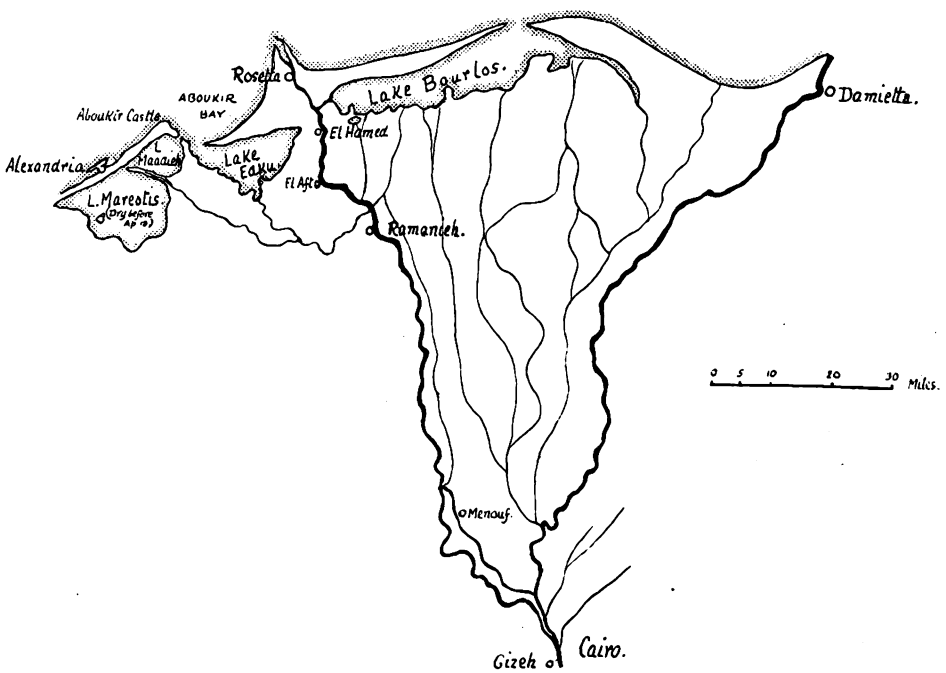
[1] "Travels in Turkey," by Wm. Wittman, M.D., Royal Artillery, 1803.

[2] The wine was probably Madeira, which was universally drunk in India for long after. In estimating his chief requirements for hospital stores for the Assaye campaign, Wellesley mentioned specially Bark, Madeira wine, mercurial ointment, calomel, and nitrous acid. Ten dozen of Madeira were authorized for the Field Hospital after the battle.

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McGrigor,[1] the future Director-General, who accompanied the force as Surgeon of the Connaught Rangers and had, by an unique concession on the part of the Indian Medical Board, been appointed superintending surgeon of the Honourable East India Company's troops.

By the middle of August Baird's force had reached Ghiza after a voyage of 400 miles down the Nile in boats. The British troops had left, but a General Hospital remained there in charge of Dr. Franck. There was now an increase in the sick rate, and, by the end of the month, when Rosetta



was reached there were 1,200 men in hospital with fever, ophthalmia and liver complaints. The medical staff sent from India, consisting of four surgeons and twelve assistant surgeons,[2] was entirely regimental, McGrigor himself retained charge of his own regiment. To this the Home Government proposed to add an inspector of hospitals, Dr. W. R. Shrapter,[3] and

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[1] Sir James McGrigor was born in 1771, studied medicine at Edinburgh and Aberdeen and, after graduating in Arts, purchased a surgeon's commission in the 88th Foot in 1793, with whom he served in Flanders, the West Indies and India. He took his M.D. degree at Aberdeen in 1804, was promoted Deputy Inspector 1805, and Inspector 1809. He was Wellington's P.M.O. in Portugal 1811-1814. Knighted 1814. Director-General 1815-1851. He was also a baronet, F.R.S., Hon. LL.D. Edinburgh and K.C.B. He died 1858.

[2] Nine of the assistant surgeons appear to have belonged to the H.E.I.C.'s service.

[3] W. R. Shrapter, M.D., Surgeon, 2nd Dragoons, 1794. Apothecary 1798. Inspector 1798. Served in Flanders and Holland. P.M.O. Copenhagen expedition 1807 and in the retreat from Corunna. He died 1833.

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a complete general medical staff of about thirty. These seemed actually to have joined, coming from the Cape, but as there was no provision made for them in the Company's regulations, Sir David Baird at first declined their services. McGrigor showed his customary tact, and it was arranged that he should retain control of the medical arrangements until the force reached Rosetta. A staff surgeon, John Foreman, two purveyors, an apothecary and three mates were also retained. The fact that the services of the remainder were not required was afterwards used as an argument by the advocates of a purely regimental system, but it seems to have been forgotten that the Indian Corps was never engaged with the enemy.

Alexandria fell on August 26, and soon afterwards the Mediterranean troops began to re-embark. On September 14, some cases of plague occurred in the hospital of the Connaught Rangers at Rosetta. Isolation was enforced, and a large building near the town adopted as a plague hospital. In October the camp was moved out to El Hamed where grass huts were built for the regimental hospitals. Cases continued to occur, and Buchan and Price, who had done such good work during the previous epidemic, gave their assistance. In January the greater part of the force moved to Alexandria. In March there were forty-six cases of plague of which twenty-two were Europeans. Pest houses were then open at Alexandria, Rosetta, Aboukir, Ghiza, and Rahmanieh. The same devotion to duty was shown by the medical officers as in the summer. Price took the disease, but recovered. Two young officers employed in the lazaretto at Aboukir, named O'Farrell and Dyson were attacked, and the former died. Thomas, at Rosetta, contracted the infection and recovered, at Alexandria Angle and Moss both died. The last five seem all to have been hospital mates in the British service.

Dr. Shrapter, for whom McGrigor had a warm regard, was now Principal Medical Officer in Egypt, and the latter had resumed his appointment as superintending Surgeon of the Indian contingent. The measures taken, comprising isolation, observation, quarantine and destruction or nitrous acid fumigation of infected clothing, held the disease in check. No special form of treatment seems to have been evolved, but mercury, both orally and by inunction, was the usual practice. Oil on the body was considered of some value as a protection. In June, Baird's force embarked at Suez where their families, in charge of two of the Company's surgeons, were awaiting them.

The landing at Aboukir Bay remained the classical example of such an operation up to the year 1915. The hospital ships to which the wounded were removed during the landing were probably ordinary transports selected on account of their shallow draught and proximity to the shore. The embarkation of the wounded was simplified by the almost immediate success of the attack. The subsequent dispersal of the sick all over the fleet, leading to an uneconomical expenditure of the small medical personnel, was somewhat paralleled at the landing on Gallipoli. In the first it was due

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to classification by units rather than by disabilities, in the second to the absence of small craft definitely allotted for ambulance purposes, and the difficulty of any form of classification on the beach under heavy fire. In neither case was there any advanced medical base where ships could unload their wounded. This could have been provided in 1915, the French took pains to provide one when they landed in Algiers in 1830, but there was no such possibility in the operations we have described.

The medical arrangements for the Home Contingent on shore were on what was then known as the general hospital system as opposed to the regimental system favoured by the Honourable East India Company. In this system, general hospitals, if formed, had to be staffed almost entirely by regimental officers. The general medical staff attached to the British forces included, besides the inspector or deputy inspector, physicians, staff-surgeons, purveyors, apothecaries and hospital mates, though the subordinate staff had to be found by the combatant units.

In India, where forty years later mahogany mess tables still found their way into the field, and every subaltern had an E.P. tent, there was normally no difficulty about the carriage of regimental hospital stores; but in Continental warfare, where transport was scarce, and the need for mobility had begun to be appreciated, the regimental hospital had been reduced by the Duke of York during active operations to the status of an aid-post. The arrangement was not popular. Some at least of the units brought their regimental hospitals up before Alexandria; the regiments, both British and Indian, in Sir David Baird's force used them throughout.

The battle casualties among the Home troops during the campaign were 23 officers and 545 other ranks killed and 169 officers and 5,949 other ranks wounded. This loss fell on a strength of about 12,000. The number of men absent from duty on account of sickness varied usually between nine and ten per cent. Plague caused 380 admissions and 173 deaths. Ophthalmia, which so many carried back to their peace stations, remained a serious cause of disability for years later. Further cases occurred during the Egyptian expedition of 1807, added to which the introduction of irritants into the eyes became a fairly common form of malingering. The situation caused some anxiety, and a special medical board was ordered to investigate it. Their report, dated February 1810, insisted on the contagious character of the disease which ten years before had not been recognized. Seven years later there was a hospital for blinded pensioners in Regent's Park of which Sir William Adams was the director.

The Indian contingent of 3,759 British and 4,127 Indians had, including casualties on the voyage, 309 and 391 deaths respectively. Of the British deaths, 38 were caused by plague, 18 were ascribed to fevers, 64 to liver complaints and 148 to dysentery. Plague accounted for 165 deaths among the natives. Ophthalmia was no less severe than in the main force, and the regiments from India, particularly the 10th and 88th Foot, contributed sixty more blind men to those already sent home. It is of interest to note

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that a number of vaccinations were performed both in the army and navy by Dr. John Walker, an ardent disciple of Jenner, who, having taken out a supply of calf lymph to Naples, joined the army at Malta.

Among the medical officers who served in Egypt some rose to considerable distinction. The most eminent was James McGrigor, whose conduct as superintending surgeon of Sir David Baird's force gained him a high reputation. He remained a regimental surgeon until 1805 when he was promoted deputy inspector, succeeding Franck as inspector in Portugal in 1811. John Webb, F.R.C.S., who was a staff surgeon in Egypt, joined as a regimental mate in 1794, and had been through several campaigns. He subsequently served as deputy inspector in the Baltic 1807, and as inspector in Walcheren 1809, from whence he was invalided home. From 1813 to 1850 he was director general of the Ordnance Medical Department. He was knighted in 1821, and was one of the first army surgeons to receive the C.B. Of the remaining staff surgeons, Summers Higgins was a Peninsula surgeon of some repute, and John Pitcairn, who was knighted in 1837, was inspector of hospitals in Ireland. James Buchan's devotion in the plague hospitals has been mentioned ; the other physician to the forces was E. N. Bancroft, a man of considerable note. He took his Cambridge degree in 1794, and entered the army as physician the following year, becoming F.R.C.P. in 1806. After the peace he went on half pay and was on the staff at St. George's Hospital. He returned later to the army, and died deputy inspector in Jamaica. He was the great exponent of the *ab æterno* origin of febrile contagion as opposed to the theory of spontaneous origin, and his writings were much read. He also engaged in the violent controversy over the relative claims of the physician and the regimental officer to high army rank, and wrote several pamphlets to prove the inferiority of the latter. On the other side McGrigor and Robert Jackson were his main opponents. The surgeons seem to have forgiven him, for in 1842 they joined the physicians of Jamaica in erecting a tablet to his memory. Among the regimental medical officers may be mentioned John Hennen of the 40th Foot, a great operating surgeon, author of a standard work on surgery and a "Medical Topography of the Mediterranean." He always operated with a cigar in his mouth, a habit which even the Duke of Wellington condoned, for he had a high opinion of him. He served in the Waterloo campaign accompanied by his son and daughter. He died as inspector of hospitals at Gibraltar during the epidemic of 1828, a man who, according to the tablet erected there by public subscription, "in the day of calamity, sacrificed all considerations of his own safety for the public weal." J. R. Hume of the 92nd was Wellington's personal physician in Portugal, and continued to attend him till his death. John Meade of the 40th, to whom Hennan was assistant surgeon, later acquired the honour of knighthood, as also did Charles Fergusson Forbes, surgeon of the Royals. The latter was physician to Westminster Hospital, 1816-1827, where he had a dispute with his surgical colleague George Guthrie, who criticized his

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views on ophthalmia. Guthrie sent him a challenge, but Forbes had already been out twice with one of Guthrie's dressers, and the duel was declined.

The campaign deserves a place in the annals of the Corps, if only for the number of medical officers who lost their lives in the performance of their duty.

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Current Literature.

GUGGISBERG, H. Experimentelle Untersuchungen ueber Aetiologie und Prophylaxe der Rachitis. **[Investigations on the Aetiology and Prophylaxis of Rickets]** *Schweiz. Med. Woch.* 1929, Nov. 16, 1145-51, 9 figs. [Women's Clinic, Univ., Berne.]

Rats on a rachitic diet were given 4—5 gm. twice daily of colostrum obtained from women during the 1st day of the puerperium, at different periods of the year. The winter colostrum allowed severe rickets to develop, the spring only mild rickets, whilst the summer colostrum protected completely. Human milk showed the same seasonal variation and contained less antirachitic factor than the colostrum. Under similar conditions rats receiving 10 gm. daily of either winter or summer cow's milk showed no rickets. It was shown that the milk of women given a large dose of vigantol on the day of delivery (in winter) protected rats against rickets, whereas the colostrum drawn off previous to the vigantol treatment had no protective effect. Artificially fed infants are much more liable to develop rickets and it has thus been argued that rickets is not simply a question of avitaminosis. Avitaminosis is, however, not merely a question of deficient intake, but factors such as absorption, excretion, intermediary metabolism play a part. Dilution and heating of cow's milk affects the ratios of the mineral salts and vitamins which probably influences their absorption. The artificially fed child is more liable to alimentary trouble and it has a lowered resistance to the effects of an avitaminosis. In the interests of the child it is urgently necessary to pay attention to the prenatal feeding and hygiene of the mother which, particularly in the poorer classes, is totally unsuitable, as the fact that in winter the mother's milk is completely devoid of vitamin D fully demonstrates.

H. N. H. GREEN.

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GUGGISBERG, H. Die exogene Beeinflussung des Plazentarstoffwechsels. Ein Beitrag zur Prophylaxe der Rachitis. **[Exogenous Factors in Placental Metabolism. Contribution to the Prophylaxis of Rickets.]** *Deut. Med. Woch.* 1929, v. 55, 1953-6, 7 figs. [1 ref.] [Women's Clinic, Univ., Berne].

It has been shown in the case of all the vitamins that the mother tends to give up her reserves to the fœtus and that increasing the mother's intake causes an increase in the vitamin reserves of the fœtus. It would seem that the placenta merely acted as a transmitting medium but the present work seems to indicate that it serves as a storage depot and as a compensating medium between mother and child. Normal human placenta, freed from blood, was fed to rats on a rachitic diet in amounts of 1 c.c. daily. The rats developed only a slight degree of rickets as compared with the severe rickets of the controls. Rats receiving placenta from women who had received 1 drop of vigantol daily during the end period of pregnancy showed no signs of rickets thus indicating that the vitamin D content of the placenta had been increased by the increase of this factor in the mother's diet. It was shown, in rats, that when the vigantol was added to the maternal diet the susceptibility of the young to rickets when placed on a rachitic diet after weaning was very much less than in control rats whose mothers had not received this addition to an otherwise normal diet. When the vitamin content of the mother's tissue is small the vitamin reserves of the fœtus are small and the susceptibility of the child to extra-uterine disease is increased. A child of a mother deficient in vitamin D does not show rickets at birth but is in a condition of "latent" rickets and with no reserves will develop rickets later, for the mother's milk will contain no vitamin D. Correct hygiene and prenatal feeding are of the utmost importance for, though the gross development of the fœtus is not affected, the mineral metabolism and vitamin content are much influenced by the action of exogenous factors on the placental metabolism.

H. N. H. GREEN.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 5.

BARNES, D. J., BRADY, M. J., & JAMES, E. M. **The Comparative Value of Irradiated Ergosterol and Cod Liver Oil as a Prophylactic Antirachitic Agent when given in Equivalent Dosage according to Rat Units of Vitamin D.** *Amer. J. Dis. Children.* 1930, v. 39, 45-58, 3 charts. [6 refs.] [Health Dept., Detroit.]

The tendency to employ preparations of irradiated ergosterol in place of cod-liver oil as a prophylactic and therapeutic agent in the treatment of patients with rickets has led the authors to carry out controlled tests on children where the efficacy of the two agents in equivalent dosages of

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vitamin D was compared. As a result of these experiments it is concluded that there is no justification for considering rat units of vitamin D in irradiated ergosterol as being equivalent to the same number of rat units of the vitamin in cod-liver oil as a curative and prophylactic remedy for rickets. In support of this it is shown that cod-liver oil in a dosage of 1,400 rat-units of vitamin D per day was a much more satisfactory anti-rachitic agent than was the irradiated ergosterol in the approximately equivalent rat unit dosage.

A. F. WATSON.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 5.

BEDSON, S. P., WESTERN, G. T., & SIMPSON, S. L. **Further Observations on the Aetiology of Psittacosis.** *Lancet.* 1930, Feb. 15, 345-6. [1 ref.]

In a previous communication the authors recorded the isolation of a filtrable virus from a parrot which had died of psittacosis, and which during life had been responsible for two cases of this disease in man. The present report deals with a further series of experiments, in which the earlier observations have been confirmed and extended. Twelve parrots have now been examined, but of these six only had been responsible for human psittacosis. Of the latter, three only have been examined for the presence of a filtrable virus. In each case filtrates of organ suspensions, through Chamberland L_1 candles, or through Seitz E. K. filters, have produced a fatal disease in budgerigars, and one of these strains has now been carried through three successive passages. In none of the six parrots associated with human cases of the disease was any bacillus of the Salmonella group isolated. From one of the six remaining birds, which were sent to the laboratory because they were ill, *Bact. aertrycke* was isolated from the blood and internal organs at necropsy. The authors note that, during life, there was nothing in the appearance or symptoms of this parrot to distinguish it from the birds suffering from psittacosis, but that the picture presented at the post-mortem examination was entirely different, thus affording additional evidence that *Bact. aertrycke* is not the causative organism of this disease.

In addition to the examination of material from infected parrots, budgerigars have been inoculated with citrated blood from six human cases, serum from one case and pleural exudate from one case. All have contracted a severe infection, in most cases fatal. From two of these birds the disease has been passed to other budgerigars, with filtrates prepared from the infected viruses.

W. W. C. TOPLEY.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 5.

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SHIGA, K. Studien ueber die Kultur der Leprabazillen. I. Mitteilung. **[Culture of the Leprosy Bacillus.]** *Zent. f. Bakt.* I. Abt. Orig. 1929, v. 114, 511-18, 2 figs. & 1 coloured pl. [Microbiol. Inst., Univ. Keijo.]

After repeated efforts to cultivate the leprosy bacillus, lasting in all over some 20 years, the author is able to record a series of experiments which suggest very strongly that this refractory organism has at length been induced to grow on artificial media. As with Koch's original isolation of the tubercle bacillus, patience and a hopeful persistence have been demanded; but, as the protocols show, hope was in this case even longer deferred. "The first month of my investigation," says the author, "was a pessimistic period, for the leprosy bacilli gradually decreased in number on the medium, and became degenerate. Not until after two months was it first found . . . that the bacilli showed signs of multiplication and appeared, in stained preparations under the microscope, in the form of clusters."

From five different cases of leprosy, cultures were obtained by the following method. Leprous nodules were removed, and ground up in a mortar with 5 per cent. sulphuric acid. The emulsion was placed in the incubator for 20 minutes, and then thoroughly separated in the centrifuge. The supernatant fluid was removed, and the deposit was once washed in the centrifuge with sterile saline. The deposit was then spread on the culture medium with a platinum loop.

The medium employed for primary isolation was prepared as follows. The usual cylindrical wedges of potato were heated in a vessel containing 4 per cent. glycerine broth, and the pH of the medium was then adjusted to 6·8-7·0. The wedges were then removed from the glycerine broth and placed in potato-tubes of the usual form; and the bulb at the lower end of the tube was filled with the glycerine broth. The tubes were finally sterilized in the autoclave. On this medium the leprosy bacillus produces no visible growth; though the situation of the microscopic colonies, once multiplication has occurred, may be revealed by spots of a golden-red coloration if Lugol's iodine solution is poured over the surface of the potato. Subculture to fresh potato medium results in the same slowly developing growth, invisible to the naked eye. Subculture to glycerine agar (4 per cent. glycerine broth with the addition of 1 per cent. of agar) has, however, resulted in the formation, after 2—4 weeks, of tiny colonies, greyish white in colour, and less dry than colonies of the tubercle bacillus.

The bacilli so cultivated are acid-fast and show the typical form and arrangement of leprosy bacilli.

W. W. C. TOPLEY.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 5.

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Reviews.

A Synopsis of Surgery. By E. W. Hey Groves. Ninth Edition. Bristol: J. Wright and Sons. 1920. Pp. viii + 676. Price 17s. 6d.

That this Synopsis has now reached a ninth edition since 1908 is a very clear indication of its popularity.

The original form of the book has been maintained and there is practically no alteration in the size, although many sections have been largely rewritten. A few new illustrations have also been added.

If we may make a few criticisms. The statement that with the citrate method of blood transfusion the donor must belong to Group 4 gives an unusual impression.

In connection with the pathology of "Shock," the "acapnic" theory is again repeated, and the statement that capillary tone is lost, especially in the splanchnic area, seems to hark back to the old "splanchnic pool" theory and not to indicate the condition of exæmia, with the resulting products of imperfect oxidation and their effects.

In the illustrations of gall-stones, the gall-bladder is shown as a pear-shaped organ, no idea being given of Hartmann's pouch.

There is an immense amount of information in this volume, which stands by itself as an epitome of surgery and thoroughly justifies its production.

J. M. H. F.

The Dramatic in Surgery. By Gordon Gordon-Taylor, O.B.E., M.A., F.R.C.S. Bristol: J. Wright and Sons, Ltd. 1930. Pp. 88. 40 illustrations, 11 coloured. Price 12s. 6d.

Mr. Gordon Taylor has written a most interesting book, containing examples of cases that are truly "dramatic."

No one can read the book without a feeling of admiration for what surgery can do under apparently hopeless conditions.

As an instance of the magnitude of what has been successfully performed, he quotes the case of the removal of a cystic osteoclastoma of the innominate bone. Inter-ilio-abdominal amputation was carried out. The illustrations are really beautiful, and the whole "get-up" of the book worthy of great praise.

Even the non-surgically inclined cannot fail to derive a great amount of pleasure and valuable information from reading the book. It is a valuable addition to any library.

J. H. M. F.

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DISEASE AND THE MAN. By G. Draper. London: Kegan Paul, Trench, Trübner and Co. 1930. Pp. xix + 270. Price 12s. 6d.

In this volume the author develops the principles enunciated in his former book, the "Human Constitution." The chapter dealing with the correlation of disease groups to certain types of individuals is one of great interest, though the amount of clinical material quoted is as yet much too small to allow of any definite conclusions to be formed in regard to some of the hypotheses advanced. The influence of sex in the genesis of certain pathological conditions of the human body is further dealt with, and some instances given to show that in certain diseases, which predominate in the male (such as gout) there is in the female victims of this affection a tendency to exhibit characteristics approaching the male—a condition the author terms gynandromorphism.

The book offers an opening to a study of medicine from a new point of view, the chief danger of which would appear to lead to the premature acceptance of a law of predestination in disease, albeit that Einstein himself is apparently a supporter of the view that man's activities are conditioned for each individual by his inherited endocrine system.

THE MORPHINE HABIT AND ITS PAINLESS TREATMENT. By A. Laughton Scott, M.R.C.S., B.A.(Oxon.). London: H. K. Lewis and Co. 1930. Pp. viii + 94. Price 5s.

The subject matter of this excellent little book will come as a surprise to most practitioners. It will almost certainly lead them to readjust their views as to the class of patient who comes under notice for morphinism, and also the common cause for taking to the drug. Dr. Scott's method of treatment appears to be based on Lambert's method, but the rationale is completely different. The drug is withdrawn against a gradually developed tolerance to a special mixture containing belladonna, hyoscyamus and xanthoxylum, increasing doses of luminal being given to procure sleep. Very expert nursing and management are required, but it is now recognized that in Dr. Scott's hands practically any bad average case of morphinism can be completely and permanently cured in from three to six weeks, and sometimes less.

Withdrawal shock is completely avoided by this method. No further treatment is required and the patient returns to work after, if possible, a short holiday. Dr. Scott's methods have aroused much interest among psychiatrists. Dr. Scott warns the practitioner against undertaking the treatment of the morphinomaniac by his method, as a failure is very disastrous and almost certain to occur unless he is experienced in such cases.

The unfortunate morphinomaniac's life is a complete misery to him. His one terror is that he may be unable to get the drug. Almost any

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crime will be undertaken to secure it. He is, indeed, as the author emphasizes, almost invariably dying to be cured, but cure is often pretty well regarded as hopeless by all concerned. No morphinomaniac should be allowed to drift when a speedy and permanent cure is available for the majority of cases.

PRELIMINARY NOTES ON VARIOUS TECHNICAL ASPECTS OF THE CONTROL OF CONCEPTION. By Marie Carmichael Stopes, D.Sc., Ph.D., F.L.S., etc. Published by the Mothers' Clinic for Constructive Birth Control, 108, Whitfield Street, Tottenham Court Road, London, W.1. 1930. Pp. 44. Price 6d.

This small book is an analysis of 10,000 cases who have attended the Pioneer Mothers' Clinic, London, where both pro-conceptive and contra-conceptive advice are given after examination and investigation.

As regards contra-conception, only fifty-two failures can be definitely traced, where proper care was exercised, out of the 10,000 cases and, as the authoress remarks, the failures being generally bitter and resentful (even if it is their own fault through carelessness), are much more likely to report than the satisfied.

The pro-conceptive side of this work—which consists in examination and advice to childless mothers and to mothers who wished to space later and desired children, revealed an extraordinary state of ignorance in some of the former class. The various methods of contra-conception are enumerated and the reasons for the recommendation of certain of them are given.

RESEARCHES PUBLISHED FROM THE LONDON HOSPITAL DURING 1929. London: H. K. Lewis and Co., Ltd. 1930. Price 7s. 6d. net.

This is a collection of reprints selected by the Publications Committee from the papers emanating from the London Hospital during the year. Forty-eight reprints are included, and a note is made that three articles, one on the preparation of catgut, by Bulloch, Lampitt and Bushill, another on the classification of Bright's disease, by Dorothy Russell, and the contribution on *Bacillus tetani* by Fildes to the "System of Bacteriology," all published by the Medical Research Council, have been omitted owing to the cost of reprints.

The whole collection is an indication of the vast amount of useful research work that is made possible by the organization of our great hospitals. Needless to say, the field covered is a wide one, and it is not possible to comment here on individual papers.

Most of our readers will find the articles more readily accessible in the original publications, but the collection will have a special appeal to those associated with the London Hospital.

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ROYAL ARMY MEDICAL COLLEGE LIBRARY.

LIST OF BOOKS RECEIVED DURING THE MONTHS OF JANUARY 1 TO JUNE 30, 1930.

Author or authors	Title of work	Grant or not	
Ferris	The Principles of Systematic Entomology ..	Grant	—
Boss and Fairlie	Handbook of Anæsthetics	,,	—
Bourne and Stone	Principles of Clinical Pathology and Practice ..	Gift	Col. Gray
Australia. Department of Health	The Epidemiology of Leprosy in Australia ..	,,	A.M.D.
Turner	Inguinal Hernia	,,	,,
Nederlands Indies Medical Services	Control of Endemic Diseases in the Nederlands Indies	,,	Authors
French Government, West Africa	African Conference of Yellow Fever	,,	A.M.D.
Medical Research Council ..	A System of Bacteriology. Vol. II	Grant	—
Biggar	Handbook of Bacteriology	,,	—
Ogilvie	Recent Advances in Surgery	,,	—
Bourne	Recent Advances in Obstetrics and Gynæcology	,,	—
Bailey	Branchial Cysts	,,	—
Powether	Handbook of Clinical Chemical Pathology ..	,,	—
Cheesman	Baillière's Synthetic Anatomy. Parts V, VI ..	,,	—
Evers and Elsdon	Analysis of Drugs and Chemicals..	,,	—
Parkinson	B. R. Cross Manual of Hygiene and Sanitation	Gift	Col. Parkinson
Patton and Evans	Insects. Vol. I	Grant	—
Halliburton and McDowall ..	Handbook of Physiology	,,	—
Watson and Welpy	The Medical Signpost. 1930	,,	—
Love	Shorter Surgery	,,	—
Park and William	Pathogenic Micro-organisms	,,	—
Hutchinson and Hunter	Clinical Methods	,,	—
Herman	Oldfield's Difficult Labour..	,,	—
Shaw	Naval Hygiene	,,	—
Price	Practice of Medicine	,,	—
Knowles	Medical Protozoology	,,	—
Far Eastern Association for Tropical Medicine	*Transactions of Seventh Congress.* Vol. III ..	Authors	—
Gordon-Taylor	The Dramatic in Surgery	Gift	Gen. Fawcus
Indian Government	Fauna of British India. Vol. I. Coleoptera ..	,,	Govt. of India
Jameson and Parkinson	Synopsis of Hygiene..	,,	Col. Parkinson
Fortescue	History of the British Army. Vol. XII.. ..	Grant	—
McLatchie	Treatment of Varicose Veins by Injection Method	,,	—
Kerr	Infectious Diseases	,,	—
Grays (Johnston)	Anatomy	,,	—
Manson-Bahr	Tropical Medicine	,,	—
Rood and Walker	Anæsthetics	,,	—
East	Recent Advances in Cardiology	,,	—
Brain..	Recent Advances in Neurology	,,	—
Pearson and Wylie	Recent Advances in Diseases of Children ..	,,	—
Copley and Wilson	The Principles of Bacteriology. 2 vols	,,	—
Macewen	Food Inspection	,,	—
Sherman	Chemistry of Food Nutrition	,,	—
Besredka	Immunity in Infectious Diseases	,,	—
MacKenna	Diseases of the Skin..	,,	—
Dumberbatch	Essentials of Medical Electricity	,,	—
Wright	Applied Physiology	,,	—
Rolleston	Acute Infectious Diseases	,,	—
Lindsell	A. and Q. Administrations. 2 c.	,,	—
Committee of Historical Section —	Military Operations—in Egypt, Palestine ..	—	—
	The Campaign in Mesopotamia, 1914 to 1918 ..	Grant	—
Harrison	Chemical Methods in Clinical Medicine	,,	—
American Medical Association ..	Quarterly Cumulative Index Medicus	,,	—
Indian Government	Fauna of British India. Vol. V. Birds ..	Gift	Govt. of India
Medical Research Council ..	A System of Bacteriology. Vol. V.	Grant	—
Ferree	The Soya Bean and New Soya Flour	Gift	Maj.Mackenzie
Rogers and Megaw..	Tropical Medicine	Grant	—
Indian Government	Fauna of British India. Vol. I. Cestoda ..	Gift	Govt. of India
Medical Research Council ..	A System of Bacteriology. Vol. I	Grant	—
Kittel	Hæmodynamics	Gift	Journal

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REPORT OF THE LIBRARIAN OF CONGRESS. United States Government Printing Office, Washington. 1929. Pp. xvi + 369.

This volume contains a detailed account of the transactions of the great American National Library at Washington for the fiscal year ending June, 1929. It includes a large amount of information of interest to the bibliophile and to the student of history, upon which it would be impossible to comment here.

Correspondence.

AN EXPERIMENT IN THE PROPHYLAXIS OF MALARIA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—Whilst having no objection to reasonable, and reasoned, criticism, I do claim the hospitality of your pages for my protection against certain misrepresentations by Major T. O. Thompson and Captain P. F. A. Grant in their article, "The Cantonment Anti-malaria Problem—Afterthoughts."

To make the matter as short as possible and refer only to one subject; in the second part of their article, published in the Journal for June, 1930, they refer, in no measured terms, to my paper, "An Experiment in the Prophylaxis of Malaria." After remarking on my paper they briefly refer the reader, and presumably me in particular, as an item of new information, to Yorke and Macfie's findings on the influence of quinine on the malarial sporozoite and developing merozoite. Yorke's actual words on this subject were quoted in full in the introduction to, and as the basis for, the experiment described in my paper.

They descibe my experiment as follows: "This consisted of the administration of quinine, thirty grains daily, *for eight days after leaving the last malarious camp*, up and down, on a certain hill journey, i.e., to cover 'the normal incubation period,'" and then proceed to remark on what they consider, apparently and without justification, to be my conception of the incubation period of malaria.

Omitting unnecessary words which I think no one could take to conceal or modify the sense in any way, the relevant portion of my article reads :—

"The procedure adopted was to administer a curative dose of quinine to cover the end of the normal incubation period of the disease; . . . *for eight days commencing a week after they had quitted the last of the malarious camps* on the road they would be given, after breakfast and tea,

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a medicine to prevent them from getting malaria . . . it contained . . . fifteen grains of quinine sulphate and three minims of the acid solution of arsenic . . ." (The italics, in both instances, are mine).

I do not propose to enter into further discussion with the authors on the subject matter of their article, very debatable as much of it is; but I do crave your permission, Sir, to suggest to Major Thompson and Captain Grant that their arguments and statements would carry more weight if they would take care to refresh their memories accurately as to recorded facts at the time of sharpening their pens, and wits, in the future.

Quetta,
July 1, 1930.

I am, etc.,
R. A. MANSELL,
Major, *R.A.M.C.*

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EDITORIAL NOTICES.

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VOL. LV. OCTOBER, 1930. No. 4.

Authors are alone responsible for the statements made and the opinions expressed in their papers.

Journal
of the
Royal Army Medical Corps.

Original Communications.

THE HISTORY OF SLEEPING SICKNESS IN THE SUDAN.

BY MAJOR G. K. MAURICE, D.S.O., M.C.
Royal Army Medical Corps.

(*Continued from p.* 174.)

VI.

The principle of concentration in villages was accepted by those in authority before the end of 1921. By April, 1922, the District Commissioner had earmarked a number of suitable grassy streams in parts of the district, and had ordered the people to group themselves on these. He was anxious that all villages should be on the open grassy type of stream, rather than on those that were heavily wooded, in order that the initial clearing and maintenance of the watering places should be easy for the people; the force of this argument was obvious. It looked as if the labours of the last four years were to reach fulfilment.

But I soon found these hopes premature. The people had been ordered to move, but an order to the Zande people, at that time, was quite useless unless backed by close supervision. The headmen who tried to carry out orders were deserted by half their followers, who joined those headmen who took up an attitude of passive resistance. The bigger chiefs professed ignorance of the sites allocated. The old roads and rest-houses were useless since the people had nominally moved to sites miles away. Attendances at inspections fell to half what they had formerly been, and the excuse was always that the people had run away. I was out of touch with the District

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Commissioner, who was detained in Yambio, and did not see him again till July, and shortly after that he went on leave. The situation was chaotic.

I used my summary powers as a first-class magistrate freely to begin with, but I learnt from Baz an even better weapon of offence. The people liked to have the inspections finished as early as possible in order to get back to their homes. By refusing to finish the inspections till a rest-house was built, one could secure the building of a very good grass hut twenty feet in diameter, sun and rain proof, in some four hours. Many hours had necessarily to be spent searching with the microscope for trypanosomes in suspected cases. This could be done in the shade of a waterproof sheet in the morning, and the hut was ready against the thunderstorms that usually broke in the afternoons.

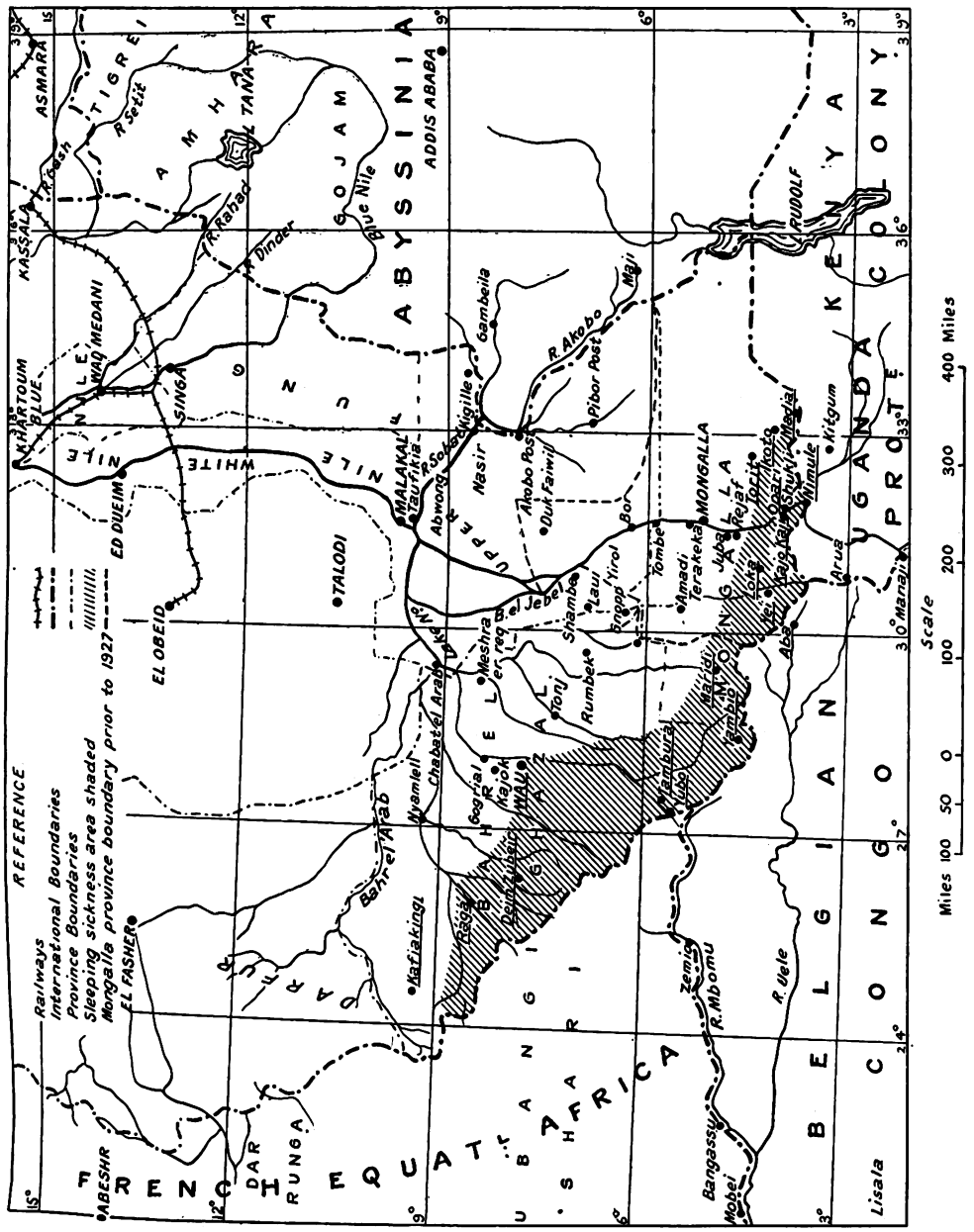
Similarly, a refusal to move to the next inspection centre till a path had been opened to it induced all to set to work from one or other end, and in a few hours the path had met in the middle.

But all this was a great waste of valuable time, and often one could not afford it, and in desperation set out through the high grass. I had brought down with me some mules and ponies to try to make trekking less arduous; but they were a great trouble at all the streams and rivers; they were always getting bogged and half-drowned, and where there were native bridges frequently fell through, sometimes ten feet into the stream below. However, they escaped serious injury, and though most of them acquired animal trypanosomiasis, all recovered with injections of atoxyl and continuous high feeding and carried on with me there for nearly four years.

For my first six months I wondered how Spence and MacKinnon had survived as long as they had. I spent the fall of the year inspecting the more accessible parts of Yambio and Meridi without finding cases. MacKinnon had found that the disease had spread north and east considerably since Spence's time, and although for the year ending September 30, 1922, the admissions had only been 434, I was convinced that this was not due to any real improvement in the situation, but rather to the fact that latterly both MacKinnon and I had discarded the attempt to deal with the centre of the epidemic, in favour of controlling its spread north and east.

In the annual report at the end of September, 1922, I put my views of the situation before the Principal Medical Officer. They did not materially differ from those expressed by my predecessors, although I stressed particularly the necessity for an extra Commissioner for Tembura District, who could be in closer touch with us than one with two districts to supervise. The Principal Medical Officer in his annual report expressed his views strongly. In effect, he said that although he knew the medical staff was inadequate, he felt that until more active administrative support was forthcoming, not only would he not reinforce the medical staff, but rather contemplated its withdrawal.

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REFERENCE
Railways
International Boundaries
Province Boundaries
Sleeping sickness area shaded
Mongalla province boundary prior to 1927
KHARTOUM
BLUE NILE
WHITE NILE
KASSALA
ASMARA
ADDIS ABABA
ABYSSINIA
AMHARA
TIGRE
GOJAM
WAD MEDANI
SINGA
EL OBEID
ED DUEIM
TALODI
MALAKAL
Taufikia
Gambeila
Nasir
Akobo Post
Pibor Post
Maji
Abwong
Sobat
Jebel
Shambe
Lau
Yirol
Rumbek
Tonj
Tombe
Amadi
Juba
Rejaf
MONGALLA
Yei
Kajo Kaji
Kitgum
Gulu
Lira
Soroti
Mbale
Jinja
Kisumu
Kericho
Nakuru
Nairobi
Kitale
RUDOLF
Marsabit
Isiolo
Meru
Nyeri
Thika
Machakos
Kajiado
Voi
Mombasa
Malindi
Lamu
Moyale
Wajir
Garissa
Kismayu
Mandera
Kotido
Lokitaung
Lodwar
Kapoeta
Torit
Kapoeta
Narus
Abeshr
El Fasher
Dar Runga
Kafia Kingi
Nyamlell
Chad el Arab
Meshra er Req
Deim Zubeir
Raga
Rejaf
Yei
Maridi
Yambio
Tambura
Yubo
Zemio
R. Mbomu
R. Uele
Bangassu
Mobei
Lisala
BELGIAN CONGO
UGANDA PROTECTORATE
KENYA COLONY
Scale
Miles 100 50 0 100 200 300 400 Miles

VII.

As a result of all this, Spence was ordered south by the Sirdar to investigate and report. He reached Source Yubo in February, 1923, and shortly after his arrival a conference of the Governor, District Commissioner, Spence and myself, was held at my house. The administrative details in dispute were discussed, and agreement reached on all important points :—

(1) The people were to be grouped on the existing roads, or roads cut for the purpose. That seemed to us the only rapid way of concentrating them.

(2) They were to be grouped round their headmen on these roads, and were to remain followers of these, and might not change allegiance to either headman or chief without permission from the District Commissioner and Senior Medical Officer jointly.

(3) The authority of the chiefs was to be supported, and the sleeping sickness requirements carried out as far as possible through the chiefs.

(4) The chiefs were to be responsible for the clearing of watering-places and road-crossings over streams and the building and maintenance of roads, bridges and rest-houses in their respective countries.

Although these were very minor administrative details they made the difference between success and failure. Above all, we insisted on the necessity for an extra District Commissioner for Tembura.

I was sure, if these provisions were enforced and an adequate medical staff provided, the epidemic could be controlled by the end of 1925. Spence wired this view to Khartoum. In March, Mr. A. C. Walker arrived and took over the duties of District Commissioner, Tembura; financial approval was obtained by the Principal Medical Officer for an increase of medical staff, which, allowing for leave, would maintain five permanently at work. It was arranged that Bimbashi Derwish, who was the senior medical officer engaged on sleeping sickness in Mongalla, and had great experience of sleeping sickness in that province, should relieve me when I went on leave. By June, 1923, the medical staff had been increased to seven, all of them, including Derwish, Syrian medical officers of the Egyptian army.

It was suggested at this time that much of the trouble of the past had been due to "continual change of Senior Medical Officers." This was not in fact the case, since each succeeding Senior Medical Officer had worked exactly on the principles originally laid down by Spence. Spence's report in 1923, says :—

> "The words 'continual change in the medical staff' should have been qualified by the statement that the first Senior Medical Officer left the district worn out in mind and body, and quite unfit to return; the second died three days after reaching

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Tembura; the third had his health permanently impaired through an attack of blackwater fever, and the fourth left the district suffering from repeated attacks of malaria at short intervals."

Twenty-two months of almost continuous trekking, and being frequently saturated with quinine, made me feel that leave was imperative. Yet it had all been so interesting that it was almost with reluctance that in May, 1923, I headed north.

VIII.

When I returned to Tembura in December, I found a most amazing change in the district. Derwish met me and told me the happenings of the last six months. The new District Commissioner had trekked all over the district with him and had quickly dispelled the people's illusion that they could continue to play off the medical and the administrative staffs, the one against the other. At first considerable firmness was necessary. But when the people found that the Government really meant business, roads were kept clear, the rivers were bridged, good solid rest-houses sprang up like mushrooms; the census of the people increased by 15,000. The admissions for the year ending September 30, 1923, jumped to 839.

Derwish with his increased staff had been able to inspect the more heavily infected parts of the district monthly, and the rest in alternate months. He had also been able to inspect the people along the Yambio-Congo frontier and had found eleven cases of sleeping sickness among them. For years we had feared infection of Yambio District and had been mystified by its prolonged immunity. It was clear now that something must be done. The only other task of any magnitude was the completion of the concentration of the people in Tembura District on the roads. Owing to the lateness of the season, when the new District Commissioner arrived it had only been possible to concentrate those living in the heavily infected area round Tembura station. The rest of the district had to be left. Apart from that, everything was running smoothly. The admission rate was already falling and it was clear that, unlike the previous falls in the admission rate, this was due to a real diminution in the incidence of the disease, since the people no longer hid from the inspections which were carried out regularly throughout the district.

From now on inspections were, by comparison, easy. Instead of rising before dawn in order to be on the road at the first light, or starting still earlier, using the light of the waning moon, one rose leisurely at six on the first appearance of the sun; instead of mounting a mule and pushing through high grass, often missing the path, sometimes dragged off over the mule's tail by the ripe grass fallen across the path, instead of being hindered by rivers and hampered by swamps, instead of arriving at a hovel exhausted from having kicked along a tired mule under a hot sun, one mounted a bicycle, pedalled leisurely along a well cleared track for an hour or two to

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enter a cool rest-house with breakfast, which had been sent on in the early hours, already set.

The people would be found ready waiting in their places, arranged under their headmen, men, women, male and female children grouped separately. The numbers would be found correct or any absentees satisfactorily explained. The counting and examination of 1,000 people for enlarged glands could be completed in about two hours while the morning was yet cool, and after breakfast. one sat down comfortably to the microscope to search for trypanosomes among the suspects.

None of us minded the discomforts of travel in unopened Africa, but they were incompatible with the job we were trying to do. In the early days we arrived at our inspection centre so late that the sun was already fiercely hot. By the time we had counted the people, argued over the missing and examined the necks of all, it would be noon or later. The people themselves standing in the sun sweated profusely and the slipperiness of the skin of the necks often made the detection of an enlarged gland difficult. And it was after this, though one had been active since before the dawn, that the search for the trypanosomes from the gland fluid of, perhaps, twenty or thirty people began, each examination requiring twenty minutes before it could be pronounced negative, though admittedly many were found positive at a glance. But we must have missed cases through sheer weariness, though we knew that each case missed would prolong the epidemic.

This rapid progress in Tembura District and its striking results modified previous opinions and, at the end of the year, a decision was reached to concentrate the people in that part of Yambio adjacent to the Congo frontier where cases had been found, and also, as a preventive measure, the people of Meridi, although that district was up to now uninfected. The rest of Yambio District would be dealt with similarly the following year. Events were indeed moving rapidly.

Unfortunately, Mr. Walker had to go on leave in the early spring and the final concentration of the people on to the roads in Tembura District, therefore, fell on us. But we were now adequately staffed, the people had seen we meant business, we were now able to act through the chiefs. We gave them till June 1 to move, and by June 1 they had moved. There was really no opposition ; a few of the older men contended that the move was a preliminary to an extensive slave raid, but no one took any notice. The roads became everywhere lined with houses and gardens, everywhere were cheerful greetings from the people, children played in the streets and thronged about one's bicycle ; instead of marching between two walls of grass one passed through a land of smiling crops and smiling people. For the year ending September 30, 1924, the admissions had fallen from 839 to 276.

By this time the staff had been reduced to four. Derwish had returned in June to Mongalla where the disease was still smouldering in Kajo-Kaji

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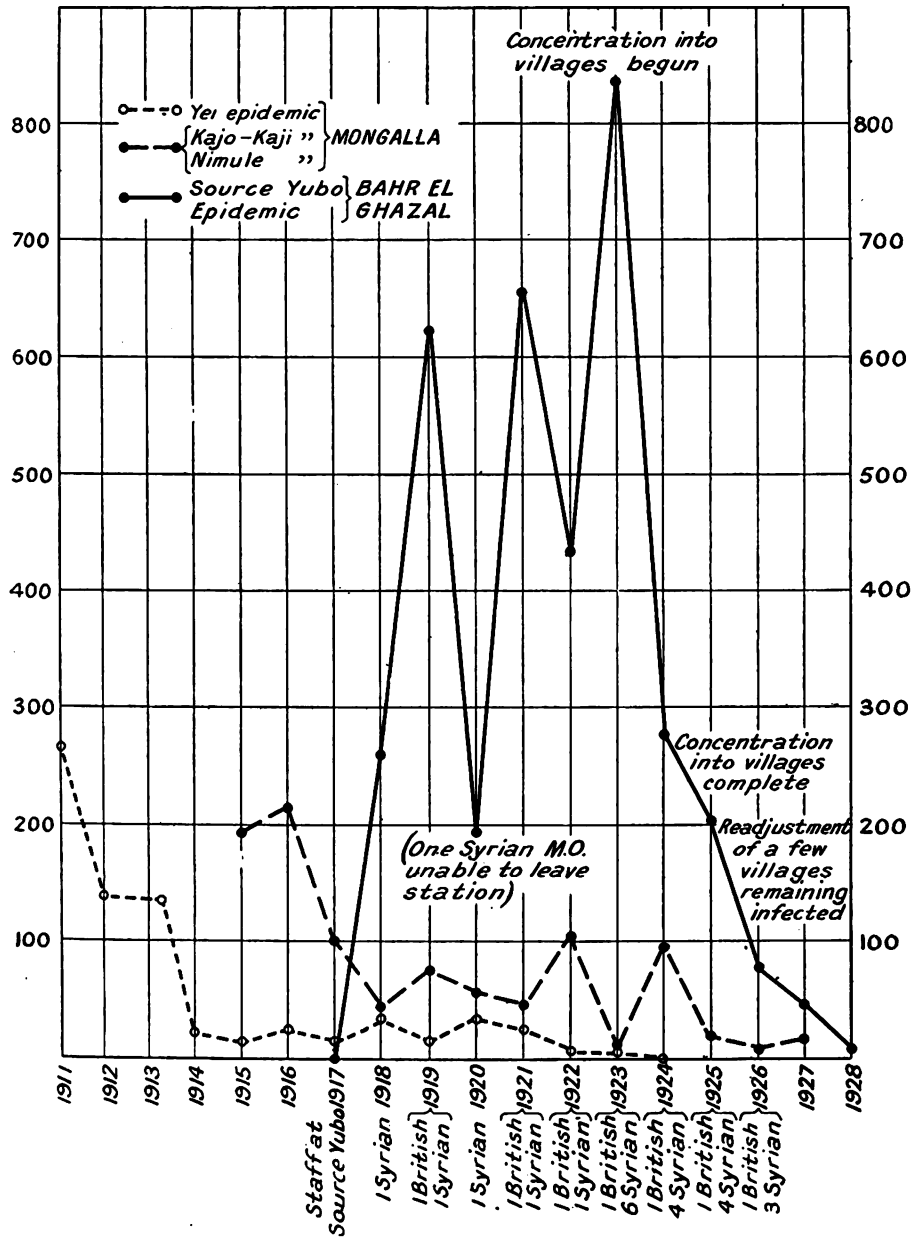


Chart showing the number of cases of sleeping sickness recorded in the Sudan, 1911—1928.

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District. His stupendous energy, great experience and unfailing optimism had been of incalculable value: it was he who had found the first cases in Yei District, and he had contributed largely to the successful ending of the epidemic there, and though he went back to Mongalla a very tired and rather sick man, he had the satisfaction of knowing that he had broken the back of a second and larger epidemic. Baz had gone on a well earned leave. El Yuzbashi Ragheb Effendi Atia filled the position of father of the Settlement as I thought no one but Baz could fill it.

All the following year we kept finding cases and small local outbreaks, and our time was taken up adjusting roads where these ran parallel to watercourses, shifting people from where infection persisted, and trying to trace the cause of local outbreaks. An enormous number of infected fly, of course, necessarily still persisted in the district, especially round the old homesteads and fishing pools, and these we found were being commonly revisited by the people. Gradually defects were remedied, but the admissions for the year ending September 30, 1925, kept up to 203.

In July, I was joined by Captain J. R. N. Warburton, M.C., who was to take over the district from me. For two months we toured together. He was quick to see that a motor cycle could replace the bicycle which I had regarded as the height of luxury. During my last thirteen months in the district I had a cyclometer, which, when I left, registered 3,500 miles. In addition I had travelled some 1,000 miles on a donkey in parts of the western district, Yambio and Meridi Districts. The western district and Meridi were still free from sleeping sickness, and the slight infection of Yambio was diminishing.

Date	Number of cases detected	Medical staff
1918	255	One Syrian Medical Officer unable to leave the station
1919	621	One British and one Syrian Medical Officer touring the district alternately
1920	192	One Syrian Medical Officer unable to leave the station
1921	656	One British and one Syrian Medical Officer touring the district alternately
1922	434	One British and one Syrian Medical Officer touring the district alternately
1923	839	One British and six Syrian Medical Officers touring and concentrating natives into villages
1924	276	One British and four Syrian Medical Officers; concentration into villages complete
1925	203	One British and four Syrian Medical Officers
1926	79	One British and three Syrian Medical Officers
1927	49	One British and three Syrian Medical Officers
1928	26	One British and three Syrian Medical Officers
	3,630	

Warburton was soon touring the district on a motor cycle. With the advent of Captain Burgess Watson as District Commissioner, roads rapidly improved and before long the motor cycle was replaced by a motor car. The astonished natives were thrilled and delighted with these innovations, inspections became almost popular. In time there was a nominal roll of

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all the heads of families, and any man whose name was read out would produce his wives and children as entered in the book. This had the advantage of fixing responsibility for absence on the individual instead of on the headman, as had been the case in our more rough-and-ready methods. 1925 was the culminating year of the epidemic. Thereafter the admissions fell rapidly: 79 in 1926, 49 in 1927, and 26 in 1928.

The admissions and the factors bearing on them are shown on the table and chart.

IX.

The administrative advantages of a population concentrated on to roads became so evident that in time it was adopted in many parts of Mongalla and Bahr el Ghazal outside the sleeping sickness areas, and the system has also been adopted in parts of the Belgian Congo and French Equatorial Africa.

Two different methods of concentration were evolved. In Tembura District, with the epidemic blazing, time was all important; it was quicker to move the people on to the existing roads or roads cut for the purpose of accommodating them, than to survey sites for villages and see that the people moved to them. The chief merit of the plan was its simplicity.

Most of the existing roads had come into being as improvements on the native paths linking headman to headman and chief to chief. There were, besides, three roads from Tembura, one north to Wau, one east to Yambio, and one to Source Yubo, and a boundary road, cut by Mackinnon, which ran parallel to and some three miles from the Congo frontier. The area between this road and the frontier was left uninhabited and people were even forbidden to cross it. This rule, of course, was regularly broken, but the unoccupied area was useful to this extent, that the paths leading to the Congo indicated very accurately where Congo traffic was greatest. None of the existing roads had been cut with a view to concentrating people on them, nor had they been surveyed with a view to permanency. It was natural, therefore, that in many places they were unsuitable both for residence and upkeep. Often the road ran parallel and close to streams, and the people would drink from these streams in preference to the clearings on the road; sometimes the road would cross the streams so frequently that the intervening spaces were useless for fly-free dwellings, and sometimes the streams were at such rare intervals that the people living on the roads would have to travel far for water. Often it was found that a road crossed a stream at a point where it was densely wooded and required great labour to maintain it clean, though half a mile away there might be a rocky patch with scanty undergrowth, needing little clearing. The roadside, too, was not always fertile. A good deal of adjustment had to be made; so far as possible this was done before the move, but two years elapsed before the adjustments were complete.

The existing roads were not enough to take the whole population and

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new ones had to be cut. We found that by far the best plan was, when possible, to make the roads follow the local watersheds. By doing so the road cut no streams and required no bridging, yet there were many springs from which the people could drink at the sources of the streams rising on either side of the watershed and round these the road was made to wind. Moreover, with the absence of bridges, the streams had only to be cleared sixty yards from their source, instead of sixty yards on either side of a bridge. It was always easier to clear a stream at its head than elsewhere in its course.

Some of the roads, before the people settled on them, swarmed with *Glossina morsitans* and made travel a misery, but once they became populated *G. morsitans* completely disappeared. I have travelled the length of Tembura District and not seen a "fly"; entered the uninhabited seven-mile belt between Yambio and Tembura Districts and found tsetse swarming; similarly, travelling north to Wau I have met no "fly" on the inhabited roads, but as the population petered out and the road became uninhabited so the "fly" increased proportionately. The reason for this is not quite clear, but it appeared that the "fly" was more intolerant of cultivations than the withdrawal of the game from the populated areas. Although *G. morsitans* was not the cause of sleeping sickness in the Sudan, its disappearance before a concentrated population is of importance, when the introduction of cattle is contemplated, and in those countries where it conveys the disease to man.

In Yambio District, owing to the small degree of infection, rapidity of concentration was not so important as in Tembura District. Major Larken, the District Commissioner, put the people into villages, each holding about 1,000 people. He planned his villages on grassy streams, where labour in clearing was least; the villages being linked by uninhabited roads. The system is efficient in the control of sleeping sickness, but the people do not like it so well as the Tembura plan. The ground round the villages becomes fouled and, consequently, flies are abundant and the uninhabited roads require more upkeep. But the maintenance of clearing and bridging is undoubtedly reduced.

For sleeping sickness purposes it is immaterial by what method the people are concentrated, so long as they are concentrated, and in such fashion that they can be inspected frequently and at any season of the year by the medical staff, and can keep their drinking places cleared.

X.—The Source Yubo Settlement.

The source of the Yubo rises twenty-five miles south-west of Tembura as a spring of limpid water bubbling out of the grey granite, whence it flows north-east to the White Nile to reach finally the Mediterranean. Two hundred yards south-west of this spring rises another, flowing south-westward into the Congo River. In the southern Bahr el Ghazal the watershed forms the international frontier of the Sudan, and along it, at

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intervals, often of not more than half a mile, rise similar springs, swelling the Nile and Congo Rivers.

It was at the source of the Yubo that in February, 1920, Baz laid out the headquarters of the Settlement and made provision for his 669 patients.

It was eighteen months later when I first saw the Settlement, when I visited Mackinnon during his attack of blackwater fever. By that time the number of patients had doubled and there were many healthy relatives living with the sick.



The source of the Soni in French Equatorial Africa, 200 yards from source Yubo.

I well remember my first impression of the Settlement. One travelled from Tembura along a fairly well-cleared path, passing through granite hills and mounting steadily all the time. For twenty miles one saw no human life nor habitation, except two empty rest-houses, and then quite suddenly the path broadened into a well-kept road lined on both sides with crops and native huts. For the next five miles one was surrounded by a chattering, laughing, inquisitive crowd of all ages and both sexes; gradually the roads became lined with banana trees and bordered with citronella grass, and then abruptly one turned at right angles on to a small cleared plateau, on which were four large mud-and-grass buildings. These were the office,

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store, Baz's house and finally Mackinnon's, the last human habitation this side of the frontier.

The road along the front of these buildings was lined with young mango trees, and in front of the two doctors' houses were flower-beds surrounding two lawns of a grass somewhat resembling English couch grass, but of a finer texture and more closely woven (*Cynodon transvaalensis*). These lawns of grass eventually came to play a part in the campaign against sleeping sickness. The forest at this time grew to within a hundred yards of the back of the houses, but in front were some hundred and fifty acres of cultivation, mostly manioc, and a grove of a few thousand banana trees. From Mackinnon's house the road continued towards the frontier, sloping gently downwards and ending at the source of the Yubo, some four hundred yards away. The spring and the stream for about two hundred yards had been cleared, and only a number of tall mahogany trees were left. Above the spring was an excellent vegetable garden, young mango trees, pawpaw trees and one young mulberry tree. This mulberry tree, though subsequently destroyed by a forest fire, also played its part.

The organization of the Settlement was based on tribal lines. The patients were divided into five divisions, each with a headman in charge. (These were afterwards increased to seven.) These groups were subdivided into sections, the men, women and boys separately; female children were classified as women. Each section of a division had its own headman, headwoman, or headboy. An area of ground with roads was allotted to each division.

It was necessary to insist that patients should live on a road in order to keep them under observation. To economize space a main road would be cut parallel to a cleared stream, and five or six others, ending blindly, were cut at right angles to it, each to accommodate a section. In course of time there were some fifty miles of roads in the Settlement. New patients were given their choice of section and division since nearly everyone had a friend or relative already in the Settlement, and if an uninfected husband wished to settle with his infected wife he was allowed to do so and bring his other wives with him, and a special section in each division was created for such cases. Eventually, as the Settlement achieved popularity, there were more healthy relatives than patients living in the Settlement, and we were put to great trouble in keeping out people with no claim to live there.

For the privilege of treatment every patient had to work for the Settlement half a day a week, and for the privilege of living in the Settlement every uninfected relative had to work ten days a year. Each division had its own day of work: No. 1, Monday; No. 2, Tuesday; and so on. There was no work on Saturdays, medicine day, and none on Sunday. It was found, however, that domestic arrangements were interfered with if the men and women of the same division worked on the same day, and this had to be altered accordingly.

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The function of the divisional headman was to be the first link of responsiblity between the medical staff and the patients; he was usually a big man in his own country. The duties of the heads of sections were more arduous. They were responsible, under the supervision of the headman of the division, for parading their sections in the early morning for work. Every day at one o'clock they had to come to the office to report deaths, desertions, absentees, and to take any orders there might be. One would have thought that an unpaid post entailing a walk of several miles daily to the office, often being kept waiting and finally paraded in front of the S.M.O., and often abused for inaccurate information, would have been unpopular. But the reverse was the case. So much does the Zande love authority that a threat to dismiss him from the post of headman was enough to ensure the most meticulous behaviour. Even the boys were the same.

Subsequently, as the novelty wore off, heads of sections would often send a deputy to the one o'clock office parade, and the privilege of so deputizing was much sought after. By this very simple means we kept ourselves perfectly informed about the most intimate details of the twenty square miles of the Settlement.

On Saturdays, all the patients paraded by divisions and sections, and received an intramuscular injection of atoxyl, each appearing in his proper place, answering his name, and receiving the weekly ration of salt as he got his injection of medicine.

Work in the Settlement began early. At the first sign of the dawn, before the sun was up, an enormous drum, hollowed out from the trunk of a tree, which could be heard all over the Settlement, was beaten. By about 6.30 a.m. the patients for work that day had collected outside the office; they were then distributed to the various jobs. Some worked on cultivations; some on clearing streams; some sawed planks; some made charcoal for the blacksmith; some fetched grass or timber for buildings; others built. Food had to be collected for the newcomers and the helpless. There was always so much work to be done that we became very ingenious in labour-saving devices. When pushed, we would send out word that every patient coming for medicine on the Saturday must bring a bundle of grass; and two thousand bundles of grass go far to thatching a house. Once a month we inspected all the healthy relatives, sometimes making them bring forest rope or banana trees from deserted homesteads. On Sundays there was no work for the patients, and the staff did such of those things that there was no time for during the week: operations, when there were two of us in the Settlement; investigations on inoculated rats; belated replies to official letters. We had 140 permanent employees, called terebai, a corruption of the Congo word travailleur, and these had to be clothed and paid. And, also, Sunday was the day when we allowed the French natives to enter the Settlement and barter wares with the patients.

This market on the boundary was the first of its kind, but now it had been copied in other parts of Bahr el Ghazal and in Mongalla. It was

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started originally in order to allow Sudan subjects to meet their relatives across the border, and prevent the crossing of the frontier by stealth; and also to allow exchange of goods between the two countries. There are many commodities used by Sudan natives which are only obtainable in the Congo; dyes, poisons, mats and so on, and when the market began there was more food in the Congo than on our side. French subjects were induced to bring goods to the Settlement in order to get money with which to pay taxes, and salt, of which all natives of those parts are physiologically starved. The ration of salt our patients received was more than their actual need, but it was and is a most important factor in the maintenance of good order in the Settlement. The patients were seldom able to earn money, but with their surplus salt they could buy those little luxuries that are almost necessities. It was the salt much more than the medicine that induced so punctilious an attendance on Saturdays, and backsliding in any direction could usually be corrected by the mere threat of cutting the salt ration of the person concerned.

Originally the market was held on Saturdays, after the medicine had been given, and sometimes, along with the vendors of goods, as many as two hundred French natives suffering from sleeping sickness would stagger over to get medicine from us. But in time the market became too unwieldy for a Saturday, and we had to change the day to allow greater supervision. There was no meat in the country other than wild game, and though at intervals we shot buffalo and antelope and occasionally hippopotami, and though occasionally the patients themselves speared game, they were always craving meat; so that when the French natives, who had more rifles than our people, brought in dried meat there was great competition. The patients acquired the habit of slipping away without paying, or would pay in what appeared to be salt carefully wrapped up in leaves, but which when opened was found to contain only small stones. For long, therefore, free fights were common.

In the course of time markets were established at other points on the frontier of the Belgian Congo and Uganda, and District Commissioners of the countries concerned met by appointment and settled cases.

The greatest difficulty we experienced in the Settlement was in clearing the streams and maintaining them fly-free. The Settlement was a network of streams and altogether ten miles of them had to be cleared. These streams start as springs bubbling out, as it were, from a blind end of a narrow ravine which quickly opens out to a swampy bed, a hundred to two hundred yards across. The sloping banks are some 15 feet high, and all along their base rise little springs, whose waters, hemmed back by vegetation and roots of trees, render the intervening space a bog, before they eventually struggle to the main channel winding along the bed. Over all tower the giant trees, while dense vegetation and creepers completely shut out the sun and make the passage of a man impossible without the use of tools. When the clearing began, chimpanzees were found in occupation

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of the trees. The initial clearing of these streams was a heartbreaking task, but their upkeep was worse. In three months after clearing the rank vegetation would have sprung up 8 feet high, and after clearing afresh, again and again this would happen. In 1924 we decided to deal with the situation once for all if we could.

The lawn of grass in front of Mackinnon's house had originated from a bundle of grass dug up from the Mission lawn at Yambio, 140 miles away; the Mission lawn had grown from a packet of seeds. By 1923 we had planted all the ground surrounding the headquarters of the Settlement—some twelve acres—with this grass. We had noticed how easily it grew and how quickly it spread, and how it destroyed other grasses and plants.



Clearing streams in the Settlement.

Moreover, its roots penetrated the ground so deeply that when it was dug up it almost immediately grew again. The method of planting it was to dig up long strips with a spade, about an inch below ground level, and then to tear off patches the size of a man's hand and to plant them about two feet apart. In a month each piece was sending out runners, and in about two months all had joined together. In 1923 we experimented with this grass on the Yubo, near its source, and so successfully did it grow and keep down other vegetation that in 1924 we planted every stream in the Settlement. Hired labourers dug up all the vegetation by the roots except the big trees. The vegetation so dug up had to be carried sometimes as much as a hundred yards through mud and water up to a man's waist, to the top of the banks where it was allowed to rot. We mobilized every able-bodied patient; the boys dug up the grass of the lawns, the women

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carried it to the streams, the men planted behind the hired labourers. The work was not unpopular; one of the medical staff was always in supervision; snakes of all colours and sizes would bolt like rabbits in harvest time coming out of corn, together with rats, and other articles of native diet.

We drained the boggy beds, cut channels, removed obstructing tree trunks. In about six months the grass was established throughout the streams of the Settlement.

At first an immense amount of weeding was necessary to prevent the young grass from being choked, but in time both bed and banks were carpeted with couch grass, and the streams so treated looked beautiful after the fierce tropical vegetation to which we had grown accustomed.

Left to itself in time the grass is swamped by other vegetation, and periodic clearing of the streams is necessary; but the work now is nothing in comparison with that of clearing the luxuriant vegetation of other days. We not only planted the Settlement streams, but we sent out orders that all clearings in the district were to be treated in the same way. Chiefs and headmen sent up parties to collect the grass from the Settlement. All our lawns were dug up about thirty times that wet weather, and yet they grew again; before the dry weather the grass was established all over the district. Finally, it was planted on bridges and certain roads to bind the surface and minimize the effects of rain.

The chief crop we grew was manioc, as yielding the greatest return for the labour. It takes two years to mature. In May, 1922, we substituted the issue of manioc for the ordinary grain ration to those newcomers without cultivations of their own, and thereafter issued no other ration than the salt, except to the comparatively few helpless cases unsupported by relatives and living in hospital. Manioc is not a complete diet, but we issued a surplus, and this surplus the recipients bartered away for other forms of food. The Settlement had become self-supporting. In 1928 the reserve food supply in the ground from this source only was estimated at 450 tons. The total communal cultivations finally reached 1,000 acres, about four-fifths manioc, the rest such foods as groundnuts, simsim and maize, which were used as food for the helpless and as seed for the other patients in the spring.

In the early days of the Settlement, elephant invaded the plantations; man-eating lion and leopard were occasionally killed by the patients; in office hours I have seen more than once a herd of hartebeest come wandering through the cultivations, and every native within sight of them discard his occupation of the moment, and set out in pursuit. From the doors of my house, I have seen buffalo, waterbuck, roan antelope, hartebeest and many other forms of game, not four hundred yards away, and at one time while I was out on inspection a herd of waterbuck grazed my garden regularly at night and took shelter from rain in the verandah of my house. Quite recently Major Warburton shot two troublesome leopards close to

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his house. But for the most part now, the game avoids the Settlement itself but is plentiful on the outskirts.

The Settlement itself is really a charming station. Comfortable brick buildings have replaced the mud and grass barns. The mango trees are all bearing. Oil palms planted from Congo seed are just coming into fruit. There is a good vegetable garden in the bed of the Yubo near its source; even watercress is established; the solitary mulberry tree planted by Mackinnon has given rise to mulberry groves and avenues.

I observed one day when pruning the mulberry tree, that a branch carelessly pushed into the ground not only grew but fruited in about three months. I therefore planted a number of them. When I was leaving I



A cleared stream with only the high trees left and planted with short grass.

happened to remark, chiefly in jest, that the only economic salvation of the district, situated as it is 400 miles from the Nile, was the production of silk by means of the mulberries. An enterprising Syrian hearing this, and having a brother in the silk-growing industry in Syria, brought back silk-worm eggs after his leave. Since then silk has been grown to the full extent of the available mulberry trees, and many more mulberry trees have been planted.

The natives themselves have changed out of all recognition with the civilizing influence that has been brought to bear on them. They are happy and friendly and give no trouble, and have become anxious to get work.

The present District Commissioner, Captain Burgess Watson, has done much for the development of native industry. Besides taking an active

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interest in the growing of silk, he started at Tembura an industrial school, which, some two years ago, was transferred to Source Yubo. Excellent cane chairs are turned out which find a ready market in private houses, clubs, and on the Sudan steamers. The houses and offices of the Settlement are now furnished with well-finished mahogany furniture, locally grown and made. Major Warburton installed a water ram and tower to supply the headquarters with water and save the tedious carriage from the spring.

In the early days there was the greatest difficulty in finding enough food to eat. There were no domestic animals except fowls and dogs, and even fowls were hard to come by. Mackinnon introduced goats from the Congo, and I added considerably to the herd by obtaining sheep and goats from Wau, and at our request the Government imported 200 sheep and goats for distribution in the district. Since my time cattle have been introduced into the Settlement. The difficulty was to get them there uninfected by "fly" on the road, but with the population on the roads and the consequent disappearance of most of the "fly," some cattle reached the Settlement uninfected, while by special arrangement those infected produced calves before the disease destroyed them. Young bulls are now being trained to draw a plough to work the cultivations.

Much of the superstition of the people has left them. In the old days the patients were continually consulting their oracles and when these proved unfavourable were never happy until they had changed their residence. This was a great trouble to us and to them. Moreover, the consultation with the oracle commonly took the form of giving a lethal or nearly lethal dose of poison to a chicken; hence the shortage. Now people seldom want to move on account of omens, and chickens and eggs are abundant, and the people anxious to sell them.

Apart from sleeping sickness an enormous amount of medical work is done among the population. Syphilis, yaws and tropical ulcer, which at one time were playing havoc, are now being brought under control. The people appreciate and understand segregation, and we are at present engaged in bringing 5,000 lepers in the Southern Sudan under segregation and treatment on the lines adopted for sleeping sickness. There are already 1,000 lepers in a part of the Yubo Settlement, and a similar settlement is being created at Yambio. It is not the treatment of lepers but the feeding of them that is so costly, and these leper colonies will, we hope, be self-supporting in two years.

I have not touched in this article on the clinical aspect of sleeping sickness. There were, however, some useful records kept. In the Sudan there have been 5,430 cases of sleeping sickness treated to the end of 1928. In Mongalla Province, from 1911 to 1928, 1,698 came under treatment. Of these 990 died and 546 were discharged as cured and only 23 had to be re-admitted with signs of the disease.

In the southern Bahr el Ghazal the largest number ever undergoing

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treatment at one time at Source Yubo was 1,837 in March, 1925. Of the total 3,630 cases admitted to Source Yubo from 1918 to 1928, 1,661 died and 928 were discharged as cured, but 152 of these had to be re-admitted with signs of the disease. From Tembura District 284 patients deserted permanently, and from Mongalla Province 23.

Some useful experimental treatment has been carried out in both provinces, but it will be realized that accurate clinical observation on a big scale was impossible, since apart from our efforts to eradicate the disease we had to be our own architects, builders, road constructors, bridge builders, agriculturists, magistrates, blacksmiths, indeed, everything.

As I have shown, or tried to show, measures taken in time had shut out infection from a district five times as large as Wales; where it had gained a footing a considerable epidemic was brought under control within the space of two years. It lingered only where the medical and administrative staff was inadequate.

In the course of the campaign against sleeping sickness the habits of the natives were transformed; they were no longer afraid of the white man; some had come out of the forest to become craftsmen, carpenters, builders and blacksmiths; all had learned to obey laws.

Superstition waned, agriculture prospered. The task of extirpating a disease had profoundly affected the life of a people.

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FRONTIER REMINISCENCES.

By Lieutenant-Colonel T. S. DUDDING, O.B.E.
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These notes are taken from material utilized for the preparation of two lectures on the "Medical Aspects of Frontier Warfare as experienced in the Waziristan Expedition of 1919-1920," and in their compilation free use has been made of the information contained in the official publications of the Government of India dealing with this campaign. In the light of modern progress, it may seem out of date and behind the times to draw deductions for present-day use from methods, which however sound at the time, may (or may not) be replaceable by better ones through the changes brought about by mechanization. But, on the other hand, progress in the East is not as rapid as in the West, and the time is not yet ripe for making a complete discard of old ways and means, and therefore it is hoped that some readers at least may find help and interest in perusing these happenings of a decade ago. At this interval, incidents do not stand out in one's mind with the clarity one would have liked, and many details of value are perforce omitted.

It will be remembered that these operations took place as a sequence of the Afghan War of 1919. The Mahsuds and Wazirs had taken advantage of the general disturbance created by the World War, and commitments elsewhere had prevented the Indian Government from paying as much attention to its Frontier troubles as would keep the predatory instincts of the tribesmen in check. Consequently the line of occupied posts had been withdrawn, or, perhaps more correctly, driven eastwards, and these successes coupled with promises from Afghanistan brought about a situation which was causing considerable loss in life and property in India and had become a serious menace, in view of the general unrest prevailing in the country at the time.

Waziristan is a portion of the country which separates India proper from Afghanistan. In shape it is a rough parallelogram with its long diagonal running south-west to north-east, and with sides of 110 by 60 miles—its approximate area being 6,000 square miles. It is separated from India *Cis* Indus in the East by the area known as India *Trans* Indus and the formidable River Indus, which is a great barrier in the establishment of easy communication between the two. There are no bridges across this part of the river, either railway or road, and the only two places on it of which use can be made are at Marie Indus—Kalabagh in the north, and Durya Khan—Dera Ismail Khan in the south. Approach to these places is by means of the broad gauge (5 feet 6 inches) railway from

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Rawal Pindi or Peshawar in the North, which running southwards parallel to the Indus passes near Marie Indus, then through Kundian (where it meets a junction line from Lahore) to Durya Khan, and onwards to join eventually the line to Karachi, and incidentally also that to Quetta.

At Marie Indus the Indus is crossed by steam rail-ferry (stern-wheeled paddle-boats with detachable side barges). These are adapted to bring over trucks of the narrow gauge (2 feet 6 inches) railway of Trans Indus to facilitate transit of goods from Marie Indus station without the necessity for off-loading at the ferry. Kalabagh is the rail and ferry terminus on the west side of the river, whence the narrow single line runs to Tank and, by its extension, to Kaur Bridge, with a branch proceeding to Bannu from Lakki Marwat Junction. The distance to the two places is about ninety and eighty miles respectively. In the hot weather a day journey on this line in its almost Lilliputian coaches is not a joy ride.

From Durya Khan to Dera Ismail Khan transit is by road, some fifteen miles or so, the Indus being crossed in the non-flood season by a boat bridge and at other times in small launches and country boats. A modified rail connection is established with Tank by means of a Decauville railway which runs alongside the forty miles of road connecting D.I.K. with Tank.

The headquarters of the force, which was based on Lahore, was at Dera Ismail Khan, and its advanced bases were at Bannu and Tank, both of which are situated in Trans Indus India, just outside the eastern boundary of Waziristan, on main trade routes connecting India with Waziristan and with Afghanistan. Motor communications ran from Dera Ismail Khan to Khirgi, fifteen miles to the north-west of Tank through Kaur Bridge and Manzai, and also to Bannu and thence for a further forty miles westward to Dardoni. Except for one or two small offshoots there were then no other roads passable for motors, and it will be noted that Kalabagh is not connected by motor road with the interior. Westward of Bannu and Tank, except as above stated, pack transport was the normal method of conveyance.

The country is on the whole barren, and is a "tangle of ravines and difficult hills, rising towards the watershed dividing the Indus and Helmad basins which lie in the western Suliman range of mountains"; this is a formidable barrier between it and Afghanistan, to which access is gained through certain passes.

There are four main rivers with their branches, and they are rendered important by the fact that the usual channels of communication are up and down their beds, which are wide, thickly strewn with boulders and stones, and are dry during the non-rainy season except for very tortuous central channels. During the rains and the melting of the snows they are liable to become dangerous and impassable owing to the spates which occur suddenly. They vary greatly in width and are generally flanked by high hills which in places recede, leading to the formation of cultivated patches known as "kachs," whilst in other places they cut through the

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hills at right angles and form narrow gorges or "tangis" which are exceedingly strong points of defence when opposing an advance.

The general altitude of the country rises from under 2,000 feet on its eastern border to between 7,000 and 8,000 feet on its western one, whilst its mountains rise to heights of 11,000 to 12,000 feet. This considerably affects meteorological conditions with the result that the uplands have a pleasant summer climate, whilst in the winter they are subject to biting winds and considerable frost and snow. On the eastern side of lower altitude the summer climate is exceedingly trying, and in addition to excessive temperatures, residence in this part of the frontier is rendered less desirable by the heavy incidence of malaria. The heat of Tank can be intense, though drier than that of Bannu, which is not so hot owing to the presence of irrigation streams and more vegetation.

Owing to the lack of fertility of the hill country, there is frequent necessity for its inhabitants to draw on the relative abundance of the plains along the eastern boundary. So long as they have the wherewithal to effect the exchange amicably all goes well and there is peace on the Frontier. But often it proves much more profitable for the hill men to come down and replenish their stores, giving nought in return. These periodic descents may be partly on account of seasonal failure, but are also on account of their predatory habits and the knowledge that they are safe from retaliation in their own inaccessible hill country. On such grounds are the foundations of frontier expeditions laid.

It will be readily seen how warfare in such a country as this has its own problems to be tackled. The determined nature of its inhabitants and its rugged character require a similar type of soldier to undertake warfare there. The Ghurka or the Garhwali is more at home in it than is the sepoy from the plains. Armaments are simplified by the lack of artillery on the part of the enemy and the difficulties in the way of the use of wheeled transport. On the other hand, the absence of roads increases enormously the troubles of transportation of baggage, supplies and casualties, and these difficulties are further added to by the fact that the country possesses practically nothing which can lessen the amount of material that has to be carried daily to meet the needs of the forces, with the exception perhaps of a little firewood when the uplands are reached and camps become fixed. The climatic conditions likely to be encountered require special consideration, as do also other characteristics which affect the maintenance of health of the troops and have a bearing on the liability to particular diseases and on the abnormal sanitary problems.

The nature of the fighting is greatly affected by the characteristic methods of warfare adopted by this particular type of enemy. He is a foot soldier, but an extremely agile and active one, with powers of very rapid movement and of great endurance. He travels light, having no equipment save his rifle and ammunition, and perhaps a long knife. His bodily needs are small, and the transportation of baggage and

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supplies is therefore reduced to a minimum. He is hardened to the climate and exposure to it affects him much less than it does an enemy unaccustomed to it, though he looks on it as a great hardship when he is disturbed at night after the day's fighting. He has keen vision, knows how to use his rifle and make use of cover, he is a master of strategy and ambush, and seizes at once any opportunity of "getting in" due to lack of care or watchfulness and mistakes on the part of his foe. Singly he will lie out hidden for the opportunity of sniping, and in small parties he will make long marches and wait in ambush to catch detached bodies unawares, and will vanish quickly, the richer by a few rifles, ammunition or other portable supplies, to say nothing of a few animals on which to carry them, though these hinder his mobility. Amongst their numbers are ex-militia men, and N.C.O.s and men of the Indian Army well trained in the use of arms and in military tactics. The tactics adopted in many of the fights show that the knowledge possessed by them has been made use of to their advantage.

One of the chief factors militating against their success as a fighting force is a lack of cohesion. When it is remembered that the population is divided up into a number of different tribes, and these again into a number of subdivisions, and that there is no definite national unity, it will be seen how difficult it has been for them in the past to form a united front against a common enemy. Internal tribal feuds have been rife, and the spiritual leaders or mullahs have much influence. Their headmen, known as maliks, are selected from the rank and file and not by heredity. The powers of the maliks are very much limited by the aspirations of the younger and more turbulent sections, and threats of assassination frequently end in reality if a headman tries to exert his authority too much on his own lines.

In this particular campaign there appears to have been a considerably greater amount of cohesion than heretofore with the result that they presented a very formidable front. On an appreciable number of occasions success was morally theirs, and had they been able to push home their advantages a different story might have had to be told. It is estimated that at the end of the campaign the number of fighting men amongst the Wazirs amounted to 23,000, and amongst the Mahsuds to 16,000; but as their effective strength depends on their number of modern rifles, the total numbers that can be so armed are in the neighbourhood of 22,000, whilst there are sufficient smoothbores and other obsolete weapons to arm the remainder. But the getting together of these into one whole force has not occurred. Their numbers are diminished by difficulties as regards supplies, by the distance from their own tribal areas which it is necessary for some of them to cover, and by the fact that it has been possible to deal with them in portions and so come to some sort of agreement with some of the tribes who are more disposed to be friendly. The result of this has been that the largest "lashkar" of rifles which has assembled to oppose us at one time

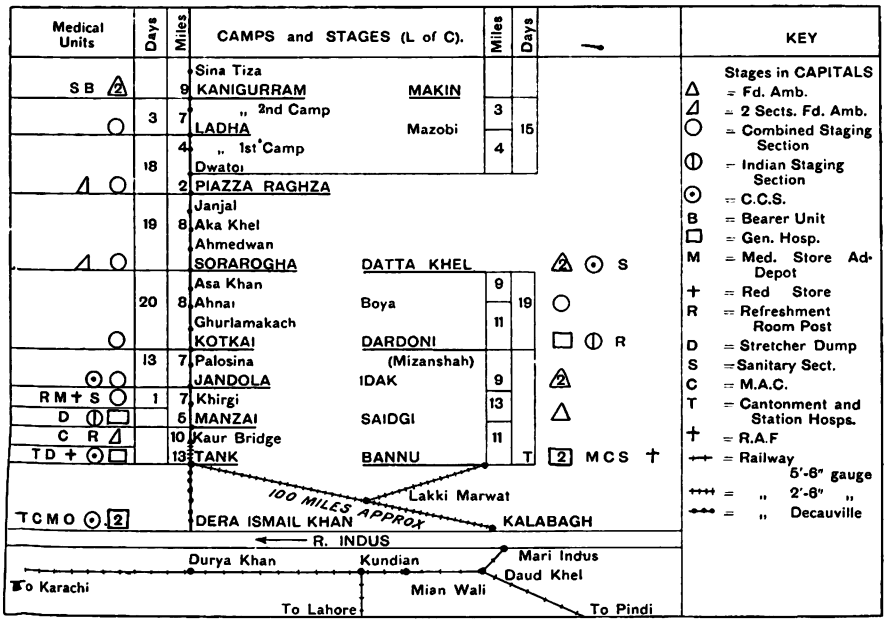
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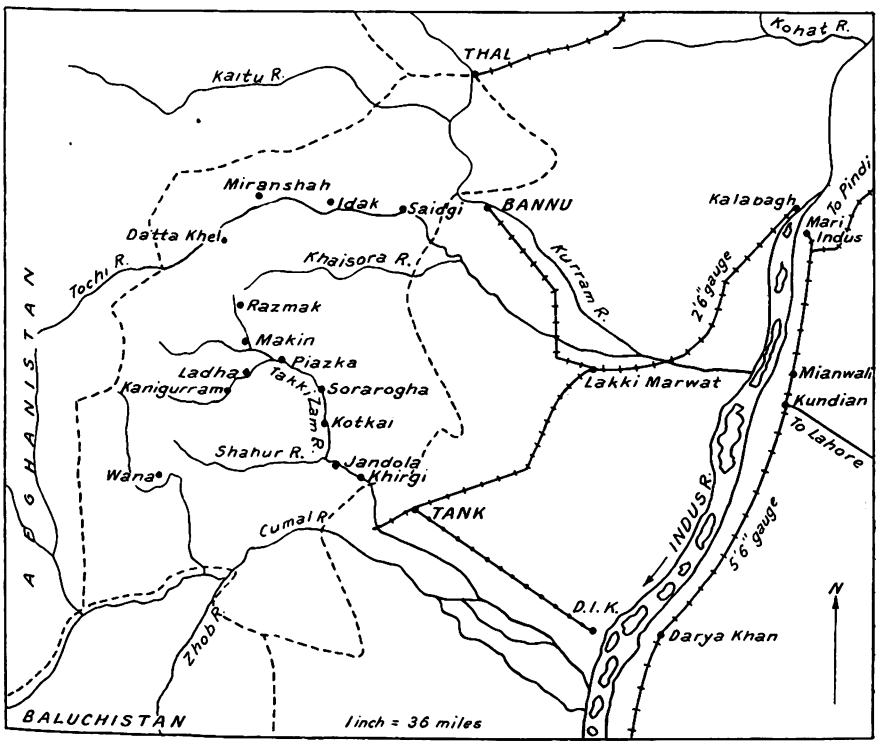
was about 8,000, whilst an average would be about 4,000 to 5,000. So that when the actual number of rifles in their firing line is compared with those of our own striking force, the disparity is not great.

The total strength of the force under our command employed in the occupation of the numerous posts in the whole area, keeping open the lines of communication, road-making, building, transporting, etc., eventually reached the large total of 80,000. Of these only about 1,700 were British, of whom the officers numbered 1,000; so that except for command it was almost a purely Indian force. But when the composition of the actual striking force is examined, it does not seem rational that such a large total strength should be required to maintain such a comparatively small weapon. The actual fighting value of the force advancing through Ahnai Tangi on January 14, 1920, amounted approximately to cavalry 1 troop, artillery 2 mountain batteries, infantry 2 brigades, pioneers 1 battalion, sappers and miners 1 company, together with the requisite numbers of attendant administrative services, which on account of the large amount of transport necessary raised the total to a figure of between 12,000 and 15,000 men under the command of the G.O.C. Striking Column. But it must be remembered that the system of advance adopted necessitated the maintenance and protection in strength of long lines of communications, and the continuous keeping up to strength of the actual fighting force which required many changes in its units; in addition the bulk of the troops were engaged in the occupation and protection of a very large area of country apart from the line of advance. A very large proportion of the troops were "New Army" troops, so to speak, that is soldiers young in age, training and experience, whilst of the battalions of older troops some of them were very badly fever-ridden through service overseas or prolonged tours in unhealthy stations in India due to Great War conditions.

The total force expressed in unit value had an approximate eqivalent of 1⅓ cavalry brigades, 2 artillery brigades, 3 armoured motor batteries, 6 infantry brigades, 5 companies sappers and miners with 20 technical works units (Labour Corps, &c.), 3 signal companies, 77 supply units, 63 transport units, 53 medical units of one kind and another, plus sundry other small units. Attention is drawn to the large number of supply and transport units, as the latter especially, in addition to the purely military problems, gave rise to a very large proportion of the sanitary difficulties that had to be overcome—camels, mules and bullocks galore with no respect for the laws of hygiene, as neither had their drivers, who for the most part were just "junglis," and could not be made to fully understand or obey the simple rules of community health protection. The animals numbered 24,000; the bullocks, being for wheeled transport, were confined to the base areas where roads existed. These areas were also served by six Ford motor van companies and a Decauville railway, which were used for carrying forward supplies beyond railhead as far as the roads permitted. Of the total number of animals some 6,000 to 9,000 were required for the striking

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Sketch map of Waziristan.

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column. The cavalry were posted in base areas of occupation and took little part in the advance beyond the first concentration of the column.

These notes are not intended to be a detailed technical description of the operations of the Expedition. An examination of the accompanying map and table will be more explanatory and give more detail than a considerable length of written description. There were in reality two separate advances: (*a*) the Tochi, on a line extending westwards from Bannu along the valley of the River Tochi to Datta Khel to deal with the Tochi Wazirs; and (*b*) the Derajat, from Tank in a north-westerly direction along the River Takki Zam to Makin and Kanigurram to deal with the Mahsuds and Darwesh Khel Wazirs. The completion of the circuit from Bannu to Tank through these areas was desirable, but the difficult country lying between Datta Khel and Makin would have made the upkeep of the lines of communication an exceedingly large undertaking. Further it was hoped that a greater concentration of the enemy would result if a single advance was made in preference to two simultaneous ones from each end of the sector of the arc of the circle, and that a more decisive defeat would be inflicted upon him.

The advance along the Tochi line took place first on November 17, the troops concentrating at Miranshah, forty miles west of Bannu, with which it is connected by a motor road running along the valley of the river, and guarded by military posts situated seven to ten miles from each other. This route was continually under attack by small parties of the enemy intent on waylaying convoys or small detached parties. It was during an attack on one of these convoys that Captain Andrews, a temporary officer of the I.M.S. drawn from Medical Mission work in the East, lost his life after having just placed in his motor ambulance the last of a number of wounded he had been able to recover by bringing it right forward into the midst of the fighting. He was accompanying the convoy in charge of a number of sick who were being transferred to Bannu. His body was taken to Bannu where, on our return from the Tochi advance the following day, we were able to attend his funeral in the cemetery there. For this act of bravery he was awarded a posthumous V.C.

There were no incidents beyond some sniping in this small expedition, there being only one casualty on our side. This division of the enemy agreed to terms after some bombing of an outlying section by the Air Force, and the column was back again at Miranshah ten days later. It had been intended to march and demonstrate in the Madda Khel country, but for political reasons, and in order not to delay the advance into the Mahsud country, this idea was abandoned. The column broke up on November 26, and the troops set out in nine groups on the long march of 140 miles to the Tank-Jandola line where they concentrated at Khirgi for the Derajat advance on December 13.

This small operation was extremely useful from a training point of view, and brought out numerous faulty details which it was possible

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to remedy for the more serious work ahead. On the medical side there was an outbreak of influenza which gave rise to a number of casualties, but as the tracks right up to the furthest point reached were made possible for the Ford vans, evacuation was much facilitated. Camel khajawahs and riding ponies for sick were tried out, with the result that changes were found necessary in the animals themselves, in the type of khajawah, and in the fitting of the pahlans (saddles), and in the saddles of the ponies. Important sanitary methods were evolved and set up as standards for all camps as far as the ground permitted ; chief amongst these were the drawing of chlorinated drinking water at central controlled points only, the collection of latrines and incinerators in groups outside the perimeter and all the animals into one area. Medical Headquarters became conspicuous by providing the only casualty, the unfortunate Indian clerk being shot through the head by a sniper whilst the staff were all sitting in the office tent at Datta Khel; but at camp Boya they were lucky, though they did not realize it till the following morning when the mess tent, which had been vacated a few minutes before the occurrence of a nocturnal outburst of sniping, was found pierced by bullet holes at table level, and the cook, who was using his water bottle as a pillow, found in it on rising, the entrance and exit holes of a bullet which had not disturbed his slumbers. In the later advance, this nightly outburst of sniping became somewhat of a nuisance, though its results were fortunately infinitesimal. The " hymn of hate " was usually timed to take place when we were having our evening meal, and was always directed towards the centre of the camp where headquarters were situated. It became necessary to dig in at night, and when tent parapets were not high it became advisable to seek shelter nearer the tent floor. Incidentally, this gave a very shrewd idea of the origin of the term " cold feet," as a very considerable difference in temperature was found to exist in the heated upper layers of air in the tent to that which was present in the region of the damp ground, so much so that warmth became preferable to protection.

Datta Khel gave us an example of a method of water collection by means of a " Koraz." In its construction the excavation of a subterranean tunnel is commenced at a likely low point, e.g., the outcrop of a trickle of water, into and beneath rising ground ; this tunnel, eighteen inches to two feet in diameter, may be a hundred or more yards in length, and, as the ground rises, gets deeper and deeper. To allow of the removal of the earth in the tunnelling, vertical shafts are let down to tunnel level every fifteen yards or more. By this means, especially if it is cut diagonally across the line of slope of the ground, the tunnel forms a gathering channel at a considerable depth from a large water-bearing area, with the result that comparatively unpolluted water is obtained in quantity at ground level without the necessity for lifting as from a well. The principle is also applied to wells, and modifications of it are found in chalk water-bearing

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strata in England. These "Koraz" were found more common in Persia than in India, though doubtless they are to be found in greater numbers in some parts of the latter country. As a contrast to this system, limited radiating tunnelling at the bottom of deep soakage pits has been found to increase appreciably their absorptive capacity, when large quantities of ablution water have had to be dealt with.

The advance of the Derajat Column from Khirgi, commenced on December 17, 1919, beyond which point of concentration wheeled traffic could not be taken. From thence onwards the route lay along the stony bed of the river except for one or two small lengths of track alongside it. Jandola was the first halt, an armed post situated just below the junction of the Takki Zam River with the Shahur River. The latter river bed is important as being the route to Wana, an important town formerly occupied as a military post which had had to be evacuated, but which it was intended to reoccupy at a later period in the present operations. The troops had barely reached camp when a determined attack was made on it by a comparatively small body of the enemy who rushed in to close quarters, using their knives and swords. This was repelled without much difficulty, and with only about a score of casualties. Jandola became a small advanced base, and here was situated the most forward C.C.S. for the reception of casualties from the Striking Force.

On the following day the main body of the column crossed the river and marched over the Spinkai Raghza or plain to Palosina higher up on the Takki Zam River. Bodies of the enemy had been reported in the neighbourhood of the river junction and up the Takki Zam, and therefore the river route was made good by the early despatch of a brigade to protect this flank. It was afterwards ascertained that the enemy expected that the force would proceed to Wana and had collected to oppose it on the Shahur River. This accounted for the comparatively small opposition encountered in clearing the Sarkai Ridge and in occupying Palosina camp. Despite this some seventy-eight casualties were incurred, the majority of which were sent back to Jandola by hand-carriage, riding pony and camel khajawah the same day. This camp was situated on the plateau on the east of and overlooking the river. On the western bank the hills rose up steeply, and on the north it was overtowered and commanded by a high ridge; the occupation of this by the enemy would have made the camp untenable, and therefore operations began on the following day to seize and make good these heights. It took us four days to do it, after very severe fighting. Inexperience, a lack of stability and appreciation of the strategy and fighting ability of the enemy caused us to have to purchase our eventual victory at the cost of 633 casualties, of whom 179 were killed.

The camping ground itself was a good one on the top of the cliff overhanging the river, but strategically it was a most uncomfortable one on account of the continual attention of the enemy from long range, a number of casualties occurring in it. The field ambulances had to deal with

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casualties again wounded after arrival in the camp, though efforts to protect the patients' tents had been made by piling bales of compressed bhusa at the sides. The Geneva Red Cross Flag was kept flying by the officer commanding one of the field ambulances who braved out the obvious attention of the enemy thereby drawn to him. This ignoring of the protection which should have been afforded to those under its cover was most probably due to a belief that it notified the position of headquarters and to an absence of knowledge of its significance. Sniping at the watering parties too was pretty continuous, animals and men having to descend for this purpose into the river bed, which was under enemy long range fire. The stretcher bearers of the medical units distinguished themselves during these operations by their good work and devotion to duty in collecting wounded under heavy fire from the steep slopes of Black Hill, from the top of which our troops had been driven by the enemy despite very gallant fighting on the part of the pioneers and sappers and miners in trying to hold the sangars they were building. But though the enemy for the moment held the upper hand, yet their losses had been so great in this engagement—between 500 and 600 as was afterwards ascertained—that they did not hold and press their advantage, and the position was recovered on the following day with little trouble. Considerable assistance during these and ensuing operations was given by the aeroplanes whose bombing and machine-gunning at low altitudes considerably harassed collections of the enemy.

In order to make good our advance, it was the policy of the General Officer Commanding to seize all the commanding heights above the river bed track and establish permanent picquets on them so as to safeguard and keep open the line of communication. As the enemy were no less acute in the knowledge of the value of these points, their possession was nearly always fiercely contested. And it was in the establishment of these picquets that most of our losses occurred. Daylight was short, and if there were no prospects of completing the work of building and wiring the large stone sangars sufficiently to give the occupants the amount of protection necessary to enable stores to be got up and to allow of the force withdrawing to camp in daylight, the work had to be abandoned and done over again the next day, as the enemy proceeded to demolish what had already been done. With more experience the troops learned to build these sangars with more expedition, as the operations were carried out under the keen attention of enemy long-range snipers. Until the line of advance passed the sangars the occupants were kept continously busy in repelling attacks by the enemy in force.

As a result of these early operations the G.O.C. decided that he required a larger proportion of troops accustomed to hill warfare in his forces and with a better knowledge of and more experience and skill in working amongst the hills themselves—in fact the sturdy nimble active Ghurka and the Garhwali and his like—and these he applied for and eventually obtained with gratifying results, as they gave him the necessary confidence and

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enabled him to undertake operations which he could not have done otherwise. In the meantime the force remained at Palosina going on with the work of establishing its picquets in the vicinity as far forward as possible, and a "Jirga" was assembling at Jandola for carrying out negotiations for settlement. Our terms were agreed to by the enemy and signed, but the advance was to continue until the conditions were complied with *in toto*. These it may be added were not carried out as it was practically impossible to control such a number of different factions and bring them to a state of agreement whereby they had to give up large numbers of their rifles and treasure. To the hillman his rifle is his treasure and his life.

So Christmas was spent here and on the previous day it was with great joy that we welcomed a visit from the D.D.M.S. of the force and some of his staff who with kindly forethought brought with them an excellent Christmas dinner for our Mess. We had been unfortunate in losing our supervising cook (and incidently the writer's bearer who had been through the South Persian campaign with him) who a day or two previously fell a victim to a long range sniper's bullet which passed through his spleen whilst squatting over his cooking just outside the mess tent—a man with no pretensions to caste who had been taken haphazard from a followers' depot when regular higher caste servants had refused to accompany their master overseas, but than whom no more faithful follower existed.

The evacuation by the medical units of some 400 casualties, in addition to sick, had been arranged for during and immediately after the first four days of fighting, after which a comparatively peaceful time ensued until the advance was continued on December 29, and on that evening Kotkai was reached at the cost of only nineteen casualties of whom only one was killed. The establishment of picquets beforehand as far forward as possible on the line of advance whilst the force waited for further supplies to be brought forward, was the method adopted to prepare for each stride in the advance. It was necessary to form a "strong point" every eight to ten miles of the route so as to form a staging post on the line of communications. Until a ten days' supply of rations, ammunition and other military requirements was collected here in addition to the four days' supply carried by the force no definite advance was commenced. A portion of the force remained behind at Palosina to cover the bringing forward of these supplies to Kotkai, and to establish and strengthen the permanent picquets considered necessary to protect the line from Jandola to Kotkai.

(*To be continued.*)

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THE CARE OF THE NORMAL SKIN.

By Major H. G. WINTER, M.C.,
Royal Army Medical Corps.

A MILITARY journal is hardly the periodical one would consult for information on beauty culture, and some justification for the inclusion of such an article in this Journal is considered necessary.

We are primarily concerned with the prevention of disease and the care of the normal skin is of paramount importance; some notes on this subject, therefore, can hardly be out of place. In this paper, moreover, an attempt has also been made to show that we have at hand cheap and highly-efficient preparations, the use of which will ensure results as good as, and in some cases better than, those of the most expensive proprietary articles.

All textbooks on dermatology teach us that the chief functions of the skin are to act as a protective covering to the body, to assist in excreting waste products and to regulate body temperature; and there the matter ends. They do not tell us how to assist the skin to perform these functions, but proceed to the consideration of the pathological conditions which arise largely from neglect of preventive measures and from maltreatment. Care of the normal skin appears to be left almost entirely to the unqualified, as is instanced by the large number of "beauty parlours" which exist—and thrive—and the proprietary articles, such as so-called "skin foods," face creams, lotions, etc., which are advertised.

In the course of duty we are constantly being consulted on face treatment, hair lotions, etc., and advice is frequently solicited as to the merits or demerits of this or that preparation; our previous training does not help us nor do textbooks. Consequently our professional reputation is apt to suffer.

The skin protects from trauma by its buffer of subcutaneous fat, by its elastic texture and by its horny external layer; moreover, the author is of opinon that bodily immunity is largely dependent on the lymphoid tissue, and that the resistance to infection of the skin is due for the most part to the large amount of such tissue which it contains. In addition, protection against the injurious action of actinic rays is afforded by pigmentation.

Excretion of waste products and regulation of body temperature are performed chiefly by the sweat glands. The sebaceous glands appear to be for the production of fats, etc., to act as lubricants.

Factors which interfere with the skin functions may be internal—such as any disturbance of the body, i.e., fevers, dietetic errors, organic disease, nervous changes, disturbance of glandular function, etc.—and external such as trauma, chemical action, etc.

The first consideration in the maintenance of a healthy skin is to ensure

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that the body generally is in a good state of health. The other excretory organs, such as the bowels and kidneys, must be kept in order or an undue amount of work is thrown on the skin ; furthermore, the circulation must be kept vigorous.

Assuming that these matters have been attended to by appropriate means, the next consideration—and one with which it is the purpose of this article to deal—is the cleansing of the skin in such a manner as to ensure the removal of waste products without damaging its surface or affecting its texture.

It has become a fetish, amongst civilized peoples at any rate, that the proper—and only—cleansing agent for the skin is soap and water. This treatment is very excellent up to a point, but it must be remembered that all soaps contain a percentage of free alkali and that water contains varying amounts of chemical substances. The effect of too much washing with unsuitable soap and hard water is the removal of the natural fats resulting in drying of the horny layer which become hard and rough so that cracks occur and later, in advanced cases, eczematous conditions arise. To visualize this state of affairs one has only to consider the rough, red, chapped hands of the household worker which may develop into the classical "washerwoman's eczema." Moreover, some skins are more susceptible to damage than others, and the skin on some parts of the body is more vulnerable. To some skins all soaps act as a veritable chemical irritant.

It must not be assumed that the author deprecates the use of soap and water, but he does consider that it should be used with circumspection. The choice of soap and the softening of water require due consideration. Household soap is extremely injurious to the skin and the use of bath salts is not a luxury but a necessity in some districts.

For obvious reasons, the merits of individual proprietary preparations cannot be discussed but some general observations are permissible.

In the first place, it may be stated that, as a general rule, those preparations which are manufactured by well-known firms with a reputation to lose are the best.

For ordinary washing purposes, a good and well-known toilet soap is an economy. As regards the body as a whole it is hardly necessary to stress the importance of a daily hot bath and frequent changes of underlinen. Bath-salts are, as a rule expensive, but they can be prepared very cheaply. Most large chemists sell, at a few pence a pound, granulated sodium carbonate especially for making bath-salts. A layer of these granules should be put in a wide-mouthed, stoppered bottle and sprinkled with any perfume and successive layers similarly treated, taking a week over the preparation of two pounds to ensure even penetration of the perfume. Most bath salts sold at great expense are modifications of this, and bath powders and water softeners are usually borax and sodium bicarbonate suitably perfumed with essential oils.

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Whilst on the subject of the body generally, one very distressing condition may, with advantage, be considered. Bromidrosis, or offensive sweating, is a very serious source of annoyance to sufferers and others with whom they come in contact. The condition arises from hyperidrosis which, in its turn, is usually of functional nervous origin; infection of the sweat by *Bacillus fœtidus* giving rise to the unpleasant odour. Usually the axillæ and feet are chiefly affected. The condition is chronic but a great deal can be done to alleviate the symptoms. Naturally the general health will receive attention and as regards local treatment, frequent washing with soap and water is necessary as also frequent changes of socks and underlinen. After washing a good treatment is to use a lotion of 1/100 formalin followed by a dusting powder such as one of the following :—

(1) ℞	Pulv. ac. salicyl.	.. ..	20 gr.	(2) ℞	Chinosol.	.. .. ..	1 dr.
	Pulv. amyli.	.. ..	1 dr.		Pulv. ac. boric.	.. ..	9 ,,
	Pulv. talc. ..	.. ..	1 oz.		Pulv. talc...	.. ..	10 ,,
	Pulv. ac. boric.	.. ..	4 dr.	(3) ℞	Pulv. plumb. subst	earat. co.	

In obstinate cases affecting the feet and also in cases of hyperidrosis of the palms with red, flabby, unsightly hands, small doses of X-ray prove beneficial and are in some cases actually curative. X-ray treatment of the skin is considered later in this article.

Certain lotions are advertised, at a price, as deodorants. We have at hand certain drugs which are very efficient in this respect. One is ac. salicyl., and another is coumarin. The latter is of interest in that it acts not by antiseptic action but it fixes odours; it is said that one part in fifty will fix the smell of iodoform and it is occasionally used for this purpose. An excellent deodorant lotion is the following :—

℞	Spirit of coumarin	.. .. ..	1 dr.
	Aquam. ..	.. ..	1 oz.

(Spirit of coumarin is made by dissolving 10 gr. of coumarin in 1 oz. of rectified spirit.)

A good lotion for perspiring hands is :—

℞	Ac. salicyl.	} āā	1 oz.
	Borax		
	Glycerine	} āā	4 ,,
	Abs. alc...		
	Ac. boric		2 dr.

Heat rash, a distressing condition, which all who have served in the tropics know only too well, hardly comes within the scope of this article, but it may, however, be stated in passing that a simple and efficient lotion for this condition is :—

℞	Calamine		2 dr.
	Ol. olivæ		4 ,,
	Ol. caryoph.		10 ♏
	Liq. carb. deter.		5 ,,
	Liq. calcis	ad	2 oz.

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Powders are also sometimes prescribed and the following is quite effective:—

℞ Pulv. ac. boric. .. .. 1 oz.
Pulv. camphor. .. .. ½ ,,
Pulv. sulphur ppt. .. .. .. 1 ,,
Pulv. zinc ox. .. .. 2 ,,
Pulv. amyli .. .. 3 ,,

It is the author's considered opinion that a large number of ladies damage their complexions by too free a use of soap and water and then attempt to repair the damage by the use of cosmetics.

As previously stated, it is not proposed to recommend any special preparations but in general face creams should be avoided as most contain lanoline which, as do most animal fats, tends to stimulate the growth of hair; this does not apply, however, to those preparations which are definitely stated not to contain animal fats or to vanishing creams.

A good routine method which cleanses and also renders the skin supple and gives it a natural bloom is first to massage in a small quantity of oil of almonds and then to wipe the face clean with a soft towel; it is surprising what a lot of dirt comes off on the towel. Almond oil is not too dear and one ounce will last a month. It is made from either sweet or bitter almonds. When pure it is very pale yellow, almost inodorous and has an oleaginous, nutty flavour. One of the chief adulterants and substitutes is oil of peach kernel which is not so good and is far cheaper.

After the oil the following lotion is gently applied:—

℞ Tr. benzoin simp. .. .. .. 1 dr.
Aq. aurant flor. .. .. .. } āā 1 oz.
Aq. elderflores .. .. .. }
Aq. rosæ .. .. .. ad 6 ,,

In dry weather, or if the skin tends to dryness, the following may be substituted:—

℞ Emuls. of bitter almonds .. .. .. 3 oz.
(Made from crushed nuts)
Aq. rosæ .. .. .. } āā 4 ,,
Aq. aurant flores.. .. .. }
Borax .. .. 1 dr.
Tr. benzoin simp. .. .. .. 2 ,,

In humid climates or with greasy skins the following is recommended:—

℞ Aq. elderflores .. .. 1 pt.
Borax .. .. ½ oz.
Eau de Cologne .. .. 2 dr.

After the lotion has dried a little vanishing cream is gently massaged in to form a basis for powder. A good and cheap vanishing cream is the Pasta Hamamelidis or Witch Hazel Snow of the B.P.C.

Ladies who carry out this treatment never touch their faces with soap and water for years on end and as a consequence their complexions are greatly improved.

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In cases where the face is inclined to be red and have dilated venules, an astringent lotion is indicated such as :—

℞ Hydr. perchlor. .. .. 2 gr.
Calamine .. .. .. } āā 3 dr.
Zinc ox. .. .. .. }
Glycerine .. .. ½ ,,
Aq. rosæ .. .. .. ad 6 oz.

A milder astringent is :—

℞ Liq. picis carb. .. .. 15 ♏
Zinc colloid .. .. .. ad 4 oz.

In cases where the skin is pale and lusterless a little tinting is permissible and a good lotion giving a natural flesh tint is the following :—

℞ Finely powdered ochre .. .. .. 10 gr.
Finely powdered bole .. .. .. 3 ,,
Zinc colloid .. .. .. ad 4 oz.

Freckles are very often a distressing condition and many lotions have been devised for their elimination ; amongst these are the following :—

(1) ℞ Ammon. chlor. .. .. 1 dr.
Aq. lavandulæ .. .. 2 ,,
Aquam .. .. ad 1 pt.
Apply with a sponge two or three times.

(3) ℞ Hydr. perchlor. .. .. 6 gr.
Ac. hydrochlor. dil... .. 1 dr.
Spir. vin. rect. .. } āā 2 oz.
Aq. rosæ .. .. }
Aquam .. .. .. 4 ,,
Apply sparingly at night and wash off next morning.

(2) ℞ Zinc sulphocarbolate .. 1 dr.
Glycerine .. .. } āā 3 oz.
Aq. rosæ .. .. }
Eau de Cologne .. .. 4 ,,

(4) ℞ Sweet cream .. .. 1 oz.
New milk .. .. .. 8 ,,
Juice of 1 lemon
Eau de Cologne .. .. 1 ,,
Alum .. .. .. 1 ,,
Sugar .. .. .. 1 dr.
Boil and skim. (Also useful for sunburn.)

For sunburn the following lotions are useful :—

(1) ℞ Aq. laurocerasi .. .. 1 oz.
Liq. carb. deterg. .. .. 15 ♏
Glyc. pb. subacet. .. .. 4 dr.
Aq. rosæ .. .. ad 8 oz.

(3) Macerate about 50 fresh quince seeds in 6 oz. of water, shake and strain through muslin, and add 2 oz. of glycerine of borax and perfume, q.s.

(2) ℞ Hydr. perchlor. .. .. ½ gr.
Eau de Cologne .. .. 1 dr.
Glycerine .. .. .. ½ ,,
Ung. elderflores .. .. 1 oz.
(Also a good application for rough skin.)

(4) ℞ Glycerine .. .. .. ½ dr.
Hydr. perchlor. .. .. 2 gr.
Tr. benzoin simp. .. .. 1 dr.
Crushed amygdal. amara decort. 2 ,,
Aq. elderflores .. ad 8 oz.
(Also useful for chapped skin.)

Whilst the above methods of skin treatment are efficient for ordinary purposes, an occasional so-called "mud pack" is a distinct advantage, as in addition to removing debris it renders the skin supple and smooths out small wrinkles. Mud packs are, however, an expensive luxury, but a cheap and efficient substitute may be prepared as follows :—

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℞	Ac. salicyl.	5 gr.
	Kaolin	5 dr.
	Dental plaster of Paris	1 ,,
	Pulv. tragacanth	12 gr.
	Glycerine	20 ♏
	Tr. benzoin simp.	3 dr.
	Liq. extr. of witch hazel	2 ,,

To be intimately mixed in a mortar and stored in a wide-mouthed, stoppered bottle (empty Lambkin's cream bottles do excellently).

The method of application is as follows:—

The face is first prepared by steaming with towels wrung out in hot water in the same manner as barbers employ them. The paste is then thickly applied all over including the neck and eyelids and allowed to dry. Whilst drying, the muscles should be as immobile as possible. As it dries the paste can be felt tightening on the skin. When completely dry it must be removed by means of towels wrung out in hot water. The face is then dried with a soft towel and a lotion applied. The whole treatment takes about half an hour and should be repeated monthly.

Although, as already stated, face creams are in general to be avoided, in some cases they are beneficial. Where the subcutaneous tissues, as a result of age or illness, have become wasted and the cutaneous muscles lax, tone and suppleness may be restored and hollows filled in by gentle daily massage with a good cream. Massage should commence at the neck and work upwards under the chin, up the cheeks and outwards and upwards from the eyes. Creams for this purpose should not contain lanoline or animal fats and a good and cheap preparation is the Ceratum Galeni of the B.P.C. (cold cream substitute) or the following:—

(1) ℞	Zinc oxide	½ dr.	(2) ℞	Ol. amygdal. dulc.	6 oz.
	Adeps benz.	2 ,,		Ol. amygdal. amar. ..	5 dr.
	Paraf. molle alb.	2 ,,		Benzoin	1 ,,
	Liq. calcis	2 ,,		Bals. tolu	5 gtt.
	Glycerine amyli	2 ,,		Ol. cajuput	2 ,,
	Ol. rosæ	1 gt.			

"Face lifting" is in the province of the plastic surgeon, but it may be stated that in the hands of an expert excellent results are obtained. A method of filling in hollows and remodelling features in vogue a few years ago, and I believe still carried out in some cases, is that of injecting warm hard paraffin into the subcutaneous tissues. This operation is not advised. In the first case the paraffin does not always remain where originally moulded but is inclined to sink by gravity, and secondly, new growths—paraffinomata—are apt to form necessitating operation and consequent disfigurement.

Whilst on the subject of face treatment a few words may be of advantage as regards superfluous hair. Many so-called remedies for this distressing condition are on the market, and the author believes that most contain either barium or strontium sulphide as their active principle. The term epilatory in connection with these chemicals is a misnomer as they do not

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epilate, they simply remove the hair to the skin level and are in fact a chemical means of shaving. The chief danger in their use is that a severe reaction may result with great inconvenience and temporary disfigurement and in some cases the patient may become sensitized.

There is no treatment for extensive hypertrichosis, but electrolysis is very effective in moderate cases. This treatment is, however, very tedious and requires a great deal of patience both on the part of the patient and the operator. A detailed description of this method of treatment is given in Stelwagon and Gasgill's treatise on "Diseases of the Skin."

X-ray epilation has its advocates but it is a highly specialized subject, and as the line of demarcation between permanent epilation and permanent scarring is so fine, this form of treatment is dangerous. Failing epilation, the hairs can be made practically invisible by bleaching with hydrogen peroxide. Recently a pencil has been put on the market for which it is claimed that H_2O_2, 10 vols., is contained in a solid form and specially suited for this purpose.

The use of lip-stick is a subject which has called for ridicule in many papers, but a little good lip-salve is a necessity in some cases and its use can prevent the occurrence of cracked and dry lips. A very useful and cheap preparation for this purpose is the Ung. rosatum of the B.P.C. or:—

℞	Paraffin dur.		1 oz.
	Vaselin alb.		1 ,,
	Ol. bergamot	āā	10 gtt.
	Ol. lemon		
	Alkannin		5 ,,

If the lips become sore, the following is good:—

℞	Paraffin dur.		1 oz.
	Paraffin liq.		2 ,,
	Camphor	āā	30 gr.
	Menthol		
	Alkanite root		
	Ol. amygdal. amara	āā	2 gtt.
	Ol. caryophylli		
	Ol. cassia		

For obstinate cracked and fissured lips the following is useful, but care must be exercised to prevent staining of the surrounding skin:—

℞	Silver nitrate	10 gr.
	Sp. æther nit.	3 dr.
	Aquam	1 ,,

Care of the hands is of the greatest importance and especially so in the case of professional men. In the winter months, in districts where the water is hard, in cases where the hands have continually to be dipped in antiseptics or other chemicals, a good hand lotion is an essential. One of the best for this purpose is the Lotio Emoliens of the London Hospital Pharmacopœia which is:—

℞	Tragacanth		44 gr.
	Tr. tolu		72 ♏
	Glycerine		5 oz.
	Aquam	ad	1 pt.

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For chapped hands a large number of remedies have been recommended of which the following are fair examples:—

(1) ℞ Glycerine .. .. .. 2 dr.
Ac. salicyl. .. .. 5 gr.
Ovi vitelli.. .. .. 4 dr.
Ung. lanoline co. .. .. 1 oz.
Ol. neroli .. .. .. 2 gtt.

(4) ℞ Aqua mellis, B.P.C.

(2) ℞ Glycerine amyli .. .. 4 dr.
Unguemol .. .. 4 „
Ol. rosæ .. .. .. 1 gt.

(3) ℞ Glycerine jelly.
(Pure glycerine thickened with trag. pulv. and scented with ol. rosæ.)

In addition, the Lotio Glycerine Co. of the B.P.C. is a cheap and good substitute for glycerine and cucumber.

Pernio or chilblains is a very distressing complaint from which quite a large number suffer, and as yet no satisfactory method of treatment has been evolved. X-ray has proved beneficial in some cases and in the author's hands radiomalt internally and the application of iodex ointment locally with massage has showed promise as a prophylactic measure. It is probable that in severe cases nothing short of the operation of sympathectomy is likely to have any lasting effect. The following are some examples of the local applications which have from time to time been recommended:—

(1) ℞ Lin. sap... .. .. 1 oz.
Ol. cajuput .. } āā 2 dr.
Tr. cantharides .. }

(3) ℞ Camphor .. .. 1 dr.
Tr. benz. simp. .. .. 5 „
Pot. iod. .. .. .. 5 „
Plumb. subacet. .. .. 5 gr.
Sp. vin. rect. .. .. 2 oz.
Aq. rosæ .. .. .. ½ „
White soap .. .. 2½ „

(2) ℞ Tr. arnica .. } āā 3 dr.
Aq. rosæ .. }
Glycerine .. }
Camphor 1

(4) Dried cucumber peelings. When required soften the inner part with water.

One skin condition which may easily be prevented is corns. Shoes and boots should be made of soft and elastic leather and great attention should be directed to fit. Cheapness in foot gear is a false economy. It is highly important also to dry the feet carefully, especially between the toes, after a bath. Treatment of corns consists of softening them with hot water and carefully paring them down. Softening can be hastened by the application of one or other of the following corn plasters or "corn cures." The former are spread on white leather and cut to the required size:—

(1) *Balsamic Corn Plaster*—
℞ Balsam of Peru .. .. 1 dr.
Ac. salicyl. .. .. 1 „
Resin .. .. .. 1 „
Turpentine .. .. 1½ „
Lanoline .. .. .. 2 „
White wax .. .. 1½ oz.

(2) *Resin Corn Plaster*—
℞ Resin .. .. .. 2½ oz.
Pulv. sal ammoniac .. ½ „

(3) *Corn Cure*—
℞ Ac. salicyl. .. .. .. 3 gr.
Ext. cannab. ind. .. .. 10 „
Alcohol .. .. .. 30 gtt.
Ether .. .. .. 1½ dr.

(4) ℞ Ac. salicyl. .. } āā 1 dr.
Ac. lactic .. }
Collodion .. .. 1 oz.

(5) ℞ Tr. iod. .. .. .. 4 dr.
Ferri iod. .. .. 12 gr.
Antimon. chlor. .. .. 4 dr.

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Warts, especially on the face, cause considerable disfigurement, and the author has had excellent results with little or no scarring with both diathermy and CO_2 snow. Preparations which are very efficient are:—

(1) ℞ Pyrogallol .. .. .. 90 gr.
Ac. carbol... .. .. 10 ,,
Ac. salicyl. .. .. 30 ,,
Adeps benz. .. .. 1 oz.

(2) ℞ Ac. salicyl. .. .. 1 dr.
Ac. lactic .. .. .. 1 ,,
Collod. flex .. .. 8 ,,

(3) One drop of ol. cinnamon on each wart.

For moles:—

(4) H_2O_2 applied on cotton-wool for about five minutes morning and evening. Soothe the resultant irritation with a face cream.

(5) ℞ Ac. acetic .. .. } āā 1 oz.
Tr. ferri perch. .. }
To be applied twice a day.

(6) Formaldehyde 40 per cent.

The bites of insects may to a large extent be prevented by the use of deterrents. Two elegant preparations of this nature are:—

(1) ℞ Ol. eucalyptus .. .. 30 m
Menthol .. .. } āā 30 gr.
Camphor .. .. }
Tr. pyrethri florum ad 2 oz.

(2) ℞ Ol. bergamot .. } āā ½ oz.
Ol. caryoph. .. }
Ol. lavandulæ .. }
Ol. terebinth. .. .. 2 ,,
Quin. sulph. .. .. 30 gr.
Sp. vin. rect. .. .. 8 oz.
Aquam .. .. ad 1 pt.

Care of the nails is of importance and the expense of manicure fees can be saved by taking a little trouble. In the author's experience, nails are as a rule carefully trimmed, but the cuticle is neglected. After trimming each nail the surrounding skin should be smeared with cold cream and the hands immersed in warm soap water for a few minutes, after which the cuticle should be gently pushed down with a soft towel. Next, take an orange stick dipped in H_2O_2 and work round the cuticle gently. Do not cut the cuticle with scissors as it leads to thickened growth later.

The following preparations are cheaply made and efficient:—

(1) *Nail Cleaning Washes*—

℞ Ac. tartaric .. .. 1 dr.
Tr. myrrh .. .. .. 1 ,,
Eau de Cologne .. .. 2 ,,
Aquam. .. .. .. 3 oz.

℞ Ac. oxalic .. .. 60 gr.
Aq. rosæ.. .. .. 2 oz.

(2) *Nail Polishes*—

Paste.

℞ Stannous oxide .. .. 5 dr.
Talcum .. .. .. 4 ,,
Tragac. pulv. .. .. 2 gr.
Glycerine .. .. .. 1 dr.
Ess. jasmin .. .. 5 gtt.
Aq. rosæ .. .. } q.s.
Carmine sol. .. }

Powders.

℞ Stannous oxide .. .. 8 dr.
Carmine .. .. .. ½ ,,
Ol. rosæ .. .. } āā 6 gtt.
Ol. neroli.. .. }

℞ Fine putty pulv. .. .. 4 dr.
Carmine .. .. .. 8 gr.
Ol. rosæ .. .. .. 5 gtt.

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(3) *For Softening the Cuticle and Curing Hang-nails—*

℞ Paraffin liq. .. .. 1 oz.
Powdered Castile soap .. 1 dr.

(4) *Nail Cream—*

℞ White wax .. } āā 30 gr.
Spermaceti .. }
Soft paraffin .. .. 1 oz.
Eosin .. .. .. 10 gr.
Perfume .. .. } q.s.
Alcohol .. .. }

(5) *Nail Varnishes—*

℞ Chloroform .. .. 10 dr.
Paraffin dur. .. .. 1 ,,

℞ Celluloid (old X-ray film, etc.).
Dissolved in amyl acetate and tinted as required.

Care of the hair is of first importance, and many of the disorders which affect it are due to want of proper care. Occasional washing and brushing is not sufficient to retain vitality. Causes and treatment of baldness are beyond the scope of this article, and if included would render it too unwieldy.

In general it may be stated that every case must be treated on its merits, and that is why so many hair lotions and pomades are advocated. Nearly every doctor has his own pet lotion which he prescribes indiscriminately; most of these have been used on particular cases with excellent results.

The first consideration, as with the skin, is cleanliness; but in some cases too much washing is harmful. For perfectly healthy hair, shampooing once a fortnight is sufficient. If the hair is very dry, three to four weeks should elapse between each washing, whereas with oily, greasy hair, once a week is not too often. Shampoo powders and lotions are easily and cheaply obtained, and most are excellent, but for those who desire to make them for themselves the following are some prescriptions:—

℞ Sp. rosemary .. .. 2 dr.
Liq. ammon. .. .. ½ ,,
Ext. quillaiæ liq. .. ad 2 oz.
Sig.—2 dr. in 1 pt. of warm water.

℞ Almond or ol. oliv. soap .. 6 oz.
Eau de Cologne .. .. 3 ,,
Glycerine .. .. .. 1 ,,
Sp. vin. rect. .. .. 3 ,,
β-naphthol .. .. 2 dr.

℞ Spirit or ether soap or flaked washing lux may also be used in emergency.

℞ Sp. rosemary .. .. 2 oz.
Sapo mollis .. .. 1 ,,
Ext. quillaiæ liq. .. .. 2 ,,
Liq. ammon. .. .. 1 ,,
Aq. dest. .. .. ad 8 ,,
Sig.—1 oz. in 1 pt. of warm water.

℞ Powdered soap .. .. 8 oz.
Anhydr. sod. carb. .. 2½ ,,
Borax .. .. .. 1½ ,,
Saponin .. .. .. 1 dr.
Ol. geraneum .. .. q.s.

Massage of the scalp is of value. This should be done, using the finger tips of both hands with a gentle, kneading motion. The movements of the

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fingers should be (*a*) from the ears to the crown, and (*b*) from the nape of the neck to the crown. This need only take three minutes daily, and is well worth the trouble.

Hair lotions should render the hair free from excess of grease and dirt, etc., should be absolutely harmless and possess a pleasant smell. They may be divided into (*a*) those which are chiefly cleansing agents, and (*b*) those which are antiseptic and/or medicinal.

Some representative hair lotions of the (*a*) class are the following:—

℞ Aq. rosæ .. .. .. 10 oz.
Glycerine .. .. .. 10 dr.
Sp. vin. rect. .. .. 1 oz.
White cocoanut oil soap .. 2 dr.
Liq. ammon. .. .. 1 ,,
Ol. geranium .. .. 15 gtt.
Ol. bergamot .. .. 8 ,,
Shake before use.

℞ Alcohol, 90 per cent .. 10 oz.
Borax .. .. .. 5 dr.
Tr. quillaiæ .. .. 15 ♏
Aq. rosæ.. .. .. 3 oz.
Eau de Cologne .. .. 2 ,,

℞ Borax .. .. .. 3 dr.
Ammon. carb. .. .. 2 ,,
Aq. rosæ .. .. .. 9 oz.
Alcohol, 90 per cent .. 4 ,,
Ether of laurel .. .. 6 gtt.
Ol. pimento .. .. 4 ,,
Ol. bergamot .. .. 15 ,,

℞ Aq. rosæ .. .. .. 8 oz.
Glycerine .. .. 1 ,,
Alcohol, 90 per cent .. 3 ,,
Pot. carb. .. .. 1 dr.
Ol. rosemary .. .. ½ ,,
Ol. lavandulæ .. } āā 5 gtt.
Ol. lemon .. }
Ol. bergamot .. .. 10 ,,
Ol. neroli.. .. .. 4 ,,
Make up without glycerine and shake; store for three days and then add the glycerine.

℞ The glycerine of lime cream of the B.P.C.

Large as are the varieties of lotions coming under the heading (*a*) even more are those in class (*b*) varying with the condition it is required to treat. A number of drugs are prescribed, the chief of these with strengths are given below:—

Tr. cantharides ..	1 dr. to 1 oz.	Ol. amygdalæ ..	2 dr. to 6 oz.
Pilocarpine nitrate or hydrochlor. ..	5 gr. ,, 8 ,,	Paraffin liq. ..	1-2 ,, ,, 6 ,,
Chloral hydrate ..	5 ,, ,, 1 ,,	Ac. salicyl. ..	5-15 gr. ,, 1 ,,
Lin. cantharides ..	4 dr. ,, 8 ,,	Resorcin ..	5-15 ,, ,, 1 ,,
		Ol. ricini ..	1-3 dr. ,, 6 ,,

Representatives of this class are:—

(1) *Lotions*—

For Oily Hair.

℞ Ac. tannic .. .. .. 10 gr.
Resorcin .. .. .. 4 ,,
Sp. rosemary .. .. 1 dr.
Aq. dest. .. .. ad 1 oz.

For Dry Hair.

℞ Chloral hydrate .. .. 3 dr.
Ol. ricini .. .. .. 3 ,,
Sp. rosemary .. .. ½ oz.
Tr. quillaiæ .. .. 2 dr.
Aq. dest. .. .. ad 8 oz.

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Stimulating.

℞	Ac. salicyl.	..	3 gr.	℞	Cantharidin	..	1 gr.
	Ol. ricini	..	1 dr.		Sp. rosemary	..	4 dr.
	Sp. hg. biniod. (1/5,000)	ad	8 oz.		Ol. ricini	..	2 ,,
					Sp. vin. rect. ..	ad	6 oz.
℞	Pilocarpine nitrate ..	..	10 gr.	(For alopecia areata—rub in on six consecutive nights and wash with soap and water containing ammonia.)			
	Quinine hydrochlor.	..	10 ,,				
	Tr. cantharides ..	..	1 oz.				
	Aq. rosemary ..	ad	4 ,,				

(2) *Pomades—*

℞	Ung. cantharides ..	..	4 dr.	℞	White wax ..	..	1 oz.
	Adeps preap. ..	..	1 oz.		Beef marrow ..	..	9 ,,
	Ol. neroli	āā	1 gt.		Ol. caryoph. ..	āā	15 gtt.
	Ol. rosæ				Ol. mace		
					Ol. geraneum ..	..	12 ,,
					Tr. cantharides ..	..	8 ɱ

In addition to the above, certain miscellaneous preparations are of value.

Hair Fixative.

℞	A. salicyl.	..	1 dr.
	Chloral hydras ..	..	2 ,,
	Tragac. pulv. ..	..	1½ ,,
	Tr. cantharides ..	..	1 oz.
	Sp. rosemary ..	..	2 dr.
	Sp. vin. rect. ..	..	2 oz.
	Glycerine	..	2 dr.
	Ol. ricini	..	1½ oz.
	Tr. quillaiæ ..	..	1 dr.
	Aq.	ad	1 pt.

Hair Curling Lotions.

℞	Liq. ammon. ..	..	1½ dr.
	Pot. carb. ..	..	2 ,,
	Glycerine.. ..	..	1½ ,,
	Sp. vin. rect. ..	..	1 oz.
	Aq. rosæ	..	10 ,,

First shampoo and dry the hair; then moisten with the lotion. It will curl on drying.

No account of hair treatment can be complete without some reference to hair dyes. Many chemical substances are used for this purpose, such as: iron, lead, bismuth and mercury salts, silver nitrate, potassium permanganate, acid pyrogallic, walnut, tannin, aniline dyes, henna, hydrogen peroxide, etc.

The majority are definitely harmful and in some cases set up an acute dermatitis which may become a weeping eczema or go on to a chronic and unsightly condition. The only dyes which can be used with any degree of safety are henna and H_2O_2.

Reference has already been made to X-rays and a short note on this very useful adjunct to treatment and to light treatment may be helpful.

As regards the latter, it may be stated at the outset that ultra-violet rays, in spite of claims made to the contrary by certain individual firms, have no depilating action. Some time ago, leading London dermatologists had occasion to complain to the Home Office of the irradicable damage done to patients by certain so-called "Beauty Specialists" who claimed to remove superfluous hair by means of ultra-violet light. The hair was removed but the patients' complexions were ruined by X-ray burns. Both these effects were the result of X-rays which were given off by the source of the ultra-violet light. View with grave suspicion, therefore, any ultra-violet lamp for which it is claimed that depilation can be effected.

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Light treatment and X-ray treatment are highly beneficial but require expert and specialized technique; as a rule this more especially refers to X-rays and a radiologist will not take on treatment unless he is constantly doing it on a number of cases.

The subject is far too big for detailed description in this article, but for those interested the following two textbooks will be found excellent reading. "Röntgen Rays in Dermatology," Arzt and Fuhs, translated by C. Kevin O'Malley (Baillière, Tindall and Cox); "Ultra-violet Radiation and Actino-therapy," Eleanor C. Russel and W. Kerr Russel (E. and S. Livingstone).

In conclusion it may be stated that the author has endeavoured to compress into a small space guiding principles only and has given a few representative prescriptions—space does not permit of more. Working on the lines indicated, however, a large number of elegant preparations can be made.

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MEDICAL ESTABLISHMENTS.

By "XAMDI."

When serving at the War Office the writer remembers two very useful articles appearing in the Corps Journal : Medical Statistics by A.M.D.2; The Supply of Medical Equipment in Peace, by A.M.D.3 (Major D. P. Watson, D.S.O.).

It is generally considered that these articles served a very useful purpose and gave in a nutshell an insight into the whys and wherefores of these two important items of our medical administration. It was suggested at the time that A.M.D.1 should respond with a similar article affecting that department.

Being now stationed in one of the cantonments of the "brightest jewel in the British crown," in an appointment less harassing than others previously held, I have taken the opportunity to write this article.

Before the practical aspect of this subject can be approached, two definitions, namely, *Establishments* and *Strength*, must be explained.

Establishments may be for *Peace* or *War*.

(*a*) *Peace Establishments* represent the statutory numbers, whether for an individual unit, corps, or for the Army as a whole, published from time to time by the War Office with Treasury sanction and for which a *fixed* sum of money is allotted annually in Army Estimates.

(*b*) *War Establishments* represent similar fixed numbers sanctioned to bring a unit, or the Army, up to necessary requirements for war, namely, by the influx of reserves to the Colours, or by special enlistment, etc.

The numbers sanctioned are shown in the respective Manuals, Peace and War Establishments, which are the authority for any individual unit or corps in the Army to employ the personnel therein enumerated.

Strength represents the actual numbers serving and consequently being paid for, on any given date. For instance, the peace establishment legislated for in estimates—let us say for the R.A.M.C.—is 400 officers, 4,000 other ranks. Suppose that on August 10, 1930, a strength return shows 402 officers, 4,050 other ranks. The Corps show 2 officers and 50 other ranks serving above authorized establishment. The fat is in the fire. More personnel are serving than Parliament has agreed to pay for. How did this excess arise—what do you propose to do about it?

This article deals only with establishments affecting the personnel of the Medical Services, i.e., R.A.M.C., A.D. Corps and Q.A.I.M.N.S.

The return from the large establishments sanctioned for the Great War to the establishments required for peace at the close of hostilities must have caused much scratching of head and paper by the Medical Department in order to arrive at an even provisional estimate, for the transition from war to peace was a matter of years, with weekly reductions taking place

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during this period in many parts of the world. In addition, the size and composition of the post-war Expeditionary Force could not be easily decided upon until those responsible could get a clear picture of the probable post-war home and international policy.

Hence it will be remembered that for some years various establishments published were always described as "Provisional." This term is now slowly being discarded except as applied to the formation of new units consequent on the policy of mechanization or motorization which is in the experimental stage.

How are the data necessary to frame the skeleton of a Peace Establishment obtained? By the issue from A.M.D.1 of a circular letter and proforma addressed to all Commands and Independent Districts at home and abroad (excluding India[1]).

"Kindly cause the attached proforma to be completed, showing the minimum number of lady nurses, officers and other ranks of the R.A.M.C. required efficiently to maintain the Medical Services in your Command." In the case of other ranks, the rank, trade and duties on which they are required to be employed should be shown.

This is circulated through the ordinary official channels of correspondence to Commands, Districts and eventually reaches the man who really should know what he wants—*the O.C.*—hospital, depot, stores, etc.

Then the trouble begins. The O.C., on receipt of this voluminous document, proceeds somewhat eloquently to refer to a type of furnace in common use or to the inadequacy of the quality of the paper for the purposes to which he would like to assign it. Then (assisted by his serjeant-major or senior non-commissioned officer), he may, or may not, depending on the availability of golf links or other essential places of recreation, spend his afternoon wrestling with the simple question asked. "What do I require?" Unfortunately most O.C.'s—I refer to the experienced ones—will argue to themselves that the memo. last received from District is another attempt to deprive them of their "habeas corpus" rights. It is *not*, but unfortunately he does not realize why these details are required, hence his reply: a bloated establishment far exceeding what he really requires. One might not cavil at this, but, not content with his efforts to reply to an "inhuman" document, he must introduce the personal "human" element which is not required, viz., marginal notes refer to Quartermaster-Serjeant GREAT, Corporal LESS and Private SMALL, whose prowess in the station billiard tournaments, at dances or at football makes their retention with his unit absolutely essential if he is "efficiently to maintain the medical services of the station."

[1] It should be noted that the Establishments for India are not included in this circular letter, as these are paid for by the India Government and are not therefore subjected to the close scrutiny of the War Office. The establishments required are mutually arranged between the Government of India, the India Office and the War Office, but are closely investigated in the first place by the former, who bear the financial cost.

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The proforma now reaches District, who do a preliminary "vetting," and pass to Command who, noting the prowess of the above-mentioned "key" men, do a further "vet" and suggest that their own chief clerk might be of a higher rank, say a Q.M.S. (with their eye on Quartermaster-Serjeant GREAT), and so on. Owing to their proximity, on the telephone, to A.M.D.1, they probably do make some reductions in what appears to be a case of gross overloading and then the document reaches A.M.D.1.

The under-dog in A.M.D.1 is thus confronted with multiple returns from many commands, districts, stations, units, etc., and then gets down to them and tries to make a fairly even picture out of them. This is very necessary, as he and his chief have to face the Establishments Committee in a few weeks' time and must be able to answer the many time-honoured questions put to them, such as why, if "A" hospital is 100-bedded you want . . . personnel more than "B" hospital with the same accommodation?

Now my readers may think that above procedure does not call for much mental effort on the part of the final "introducer" (A.M.D.1) of peace establishments, but let him have no delusions. An explanation will be enlightening. After many weeks, involving the daily carrying to and fro of a little despatch case to his suburban home and the burning of much midnight oil, he eventually, by process of eliminating the "human element" and adjusting of "overloads," arrives at a "gross" figure for the whole Corps, as necessary for *essential peace requirements only.*

He now has to investigate: (*a*) Whether this is sufficient to provide a satisfactory "regular" nucleus for the contemplated Expeditionary Force; (*b*) whether the number of warrant and non-commissioned ranks in comparison with similar Corps in the Army can be justified; (*c*) what the period of service of enlistment is to be, seven and five or nine and three years, as this affects the formation of the reserves, etc.; (*d*) what reserves may be expected to accrue from the above establishment; (*e*) what is the anticipated number of recruits required to maintain this establishment; our actuarial friends in the Finance Department assist with their wooden rules and scales in the elucidation of the last three items.

Having arrived at his conclusions, and after they have been approved or disapproved by his chief, he then announces to the A.G.'s branch that he is ready to face his judges. At the time of the writer's "residence" Peace and War Establishments were examined by two large Committees, on which all personnel branches were represented, presided over by a well-known military Director, but curbed in spirit by the stern necessities of finance as represented by a distinguished civil servant whose nationality was conducive to financial efficiency. To face such a committee required tact, an even temper and a certain amount of guile, for any officer presenting "Establishments" is regarded as having something in hand to give away, and in this traditional spirit the Committee meets.

It is unnecessary to elaborate the detail of their procedure beyond

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stating that one has to appear on many days for many weeks in the afternoons immediately after lunch—sleepy hours—and undergo acute cross examinations into the sins of the past and present life of the Corps, feeling very pleased that one has not brought Quartermaster-Serjeant GREAT and his friends into the limelight.

Every time the Committee is adjourned, many local facts about some particular hospitals or units which have been "referred" during that day's session have to be confirmed by written proofs, memos or telegrams, so as to justify further one's previous remarks when the next meeting is held.

Let us now assume—one has reached the end of these harassing afternoons—the Committee have agreed to a *final* (*sic*) figure. One feels years younger and asks for the whole of next Saturday off, hands the figures over to the hard-working soldier or civil servant clerks, and asks time to sort the notes and present the result in an intelligent form.

This having been done they are then accepted by the Army Council and presented for favour of sanction by His Majesty's Treasury. The latter will deem fit to return them several times with observations calling for further explanatory remarks. Then one cold and foggy morning your chief clerk comes in, also cold but smiling, "*Establishments* are passed, sir."

Now, my readers, you know how it is done and where your figures go in the winter time.

What has just been described at some length is the initial framing of *Peace Establishments* which have now become regularized, but there is one further annual event which always causes a flutter in hard-worked A.M.D.1—the *Estimates Committee*. Putting it briefly, Parliament votes a sum of money annually for the upkeep of the Army as a sequel to the presentation to them of the Army Estimates by the Secretary of State for War. In order to arrive at these, the medical department in the War Office is asked by A.G.'s branch to submit to them annually their establishments for estimate purposes. This is a comparatively simple affair *provided* you are making a reduction in or maintaining the same authorized establishments as heretofore, but woe betide you if you wish to increase them by one officer or other rank, for then the Director-General must be prepared to justify his demand if called upon to do so by the War Office Estimates Committee—a no easy matter in these difficult financial days.

What is not realized outside a headquarters office is that the mere asking for one additional officer or one other rank, unless one can make a compensatory reduction in establishments elsewhere, is not the simple affair it would appear to be.

SUMMARY.

(1) This article is not written in any spirit of facetiousness but merely as an attempt to explain a subject which the writer has found from experience to be one of the "*not understoods*" in the Corps.

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(2) The writer pleads (*a*) for an understanding of the difference between Establishments and Strengths whereby the "initiator" and the "introducer" of "Establishments" will be spared much unnecessary correspondence and hard work; (*b*) for a realization of the fact that the final "introducer" of Establishments is only dealing in heads and numbers and not in the family histories of individuals, and that he has no wish to remove any particular man from his unit, which is the prerogative of Officer i/c Records; (*c*) for the observation in all calculations of the rules of simple arithmetic.

(3) The subject of Establishments is a vast one, and in order that this article may not be unduly lengthened, it being understood that "yet another appreciation" has to be fitted in to the Journal, no reference has been made to other medical establishments, i.e., Reserve of Officers, Regular Reserves, Territorials, Supplementary Reserves, Military Hospitals Reserves, V.A.D.'s, all of which require careful calculation and consideration.

(4) The writer takes this opportunity of thanking his late chief in A.M.D.1 for having taught him all about Establishments, also Major E. James, O.B.E., R.A.M.C., Supervisor A.M.D.1, and Serjeant-Major, now Lieutenant A. E. Malley, R.A.M.C., retired (late A.M.D.1), for their great assistance and courtesy at all times. He is also indebted to Major-General H. Boulton, C.B., C.B.E., V.H.S., for permission to publish this article.

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Editorial.

REPORT OF THE WATER POLLUTION RESEARCH BOARD.

THERE is a gradually growing appreciation of the benefits to the community of the efforts made to ensure that the rivers and water supplies of the country are kept as free from contamination as possible.

The growth of the population and the development of industry render the prevention of pollution of greater importance every year. Pure water is required not only for domestic purposes, but also and in increasing quantities for many industrial processes. As time goes on it seems inevitable that rivers will have to be utilized to a greater extent as sources of water supply for both domestic and industrial purposes.

The uncontrolled discharge of polluting liquids from manufactories must, in many instances, render water supplies adjacent to factories quite unfit for the purposes for which they are required, and the devising of practicable methods for preventing or alleviating the effects of pollution will prove of benefit generally. From this point of view the work of the Water Pollution Research Board is of great importance. The Chairman of the Board is Sir Robert Robertson, and among its members are Professor Donnan, F.R.S., and Sir Alexander Houston. The Board was appointed in June, 1927, to submit to the Committee of the Privy Council for Scientific and Industrial Research schemes for research on the prevention of the pollution of rivers and other sources of water supply by industrial effluents and sewage and to supervise the execution of approved investigations.

The Board initiated researches on the purification of waste waters from beet sugar factories, the base-exchange or zeolite process of water softening and the activated sludge process of sewage disposal. They also proposed a general biological and chemical survey of a typical river flowing through an industrial area and suggested that the River Tees would be a suitable river for the purpose.

The manufacture of beet sugar is a seasonal industry, the season lasting about one hundred days. Lifting of the beets commences in October and extraction of the sugar is carried out during the coldest months of the year.

During the processes employed in the manufacture of sugar beet a considerable quantity of water is used. In a factory dealing with 1,000 tons of beet per day, the quantity of water employed daily amounts to three or four million gallons, and the disposal of this constituted a problem which required solution. The water used for transporting and washing the beet contained small amounts of organic and inorganic substances, and the Board found that when satisfactory methods of screening and sedimentation

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were devised for removing the small amount of suspended matter, the washing waters could be used again. The re-use of transport and washing waters is considered to be a definite step towards the solution of the problem of disposal of the waste waters from beet sugar factories. It was realized that the continued re-use of waters, even after treatment, might result in a gradual accumulation of substances in solution which might render the water unfit for further service. Except where the factory was near a comparatively large river, it would be necessary to purify the waters discharged before allowing them to enter the river. In such circumstances the Board have found that a high degree of purification can be obtained by biological filtration on percolating filters. It was necessary to have storage tanks to reduce the amount of suspended matter in the water to be applied to the filters and when the secondary filters contained material graded from $\frac{1}{8}$—$\frac{1}{4}$ inch ninety per cent purification was obtained.

Biological investigations showed that a large variety of organisms take part directly or indirectly in the work of the filters. Examination of the bacteria showed that the great majority were non-spore formers and not likely to survive the drying between the periods of treating the beet.

Samples of the gelatinous material scraped from the medium of the filters were "plated" at first weekly and later at daily intervals, and from each plate fifty colonies were taken for examination. In this way about 800 cultures have been collected. Each strain is being grown in seven different sugars and from the results obtained the bacteria are being classified. In addition to bacteria which ferment sugar, it appears that bacteria capable of fixing nitrogen are present in the filter film. It seems probable that in the purification by biological filtration the oxidation of the sugars occurs in stages and that each stage is brought about by a particular group of organisms.

Base-exchange or zeolite process of water softening has been investigated by the Board, and last year a technical paper was published. In this paper are described the principles of the process and the methods and conditions of operation and its advantages and disadvantages in relation to the lime-soda process of water softening are discussed.

In the lime-soda process sufficient calcium hydroxide and sodium carbonate are added to precipitate the calcium as normal carbonate and the magnesium as hydroxide.

In the base-exchange process certain hydrated alumino-silicates are employed. Under suitable conditions the metal combined with the alumino-silicate radical can be replaced by other metals and the process is reversible, thus:—

$$Na_2O, Al_2O_3 \times SiO_2, ?H_2O + CaCl_2 \rightleftarrows CaO, Al_2O_3 \times SiO_2, ?H_2O + 2NaCl.$$

When hard water is passed through a bed of the material the calcium and magnesium ions are removed from the water and are replaced by sodium. When the water is no longer effectively softened the material is

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treated with brine. The reverse action occurs, the sodium alumino-silicate being formed.

The phenomenon of base-exchange was discovered in 1850 by Thomas Way, who thought the process was not reversible. In 1858 Eichorn showed that the process was reversible and demonstrated the base-exchanging properties of the natural zeolites. All base-exchanging materials are called zeolites, irrespective of their strict mineralogical classification.

Gans, in the early years of the present century, was the pioneer in the application of base-exchanging silicates to water softening.

The following advantages are claimed for the base-exchange process. It yields a water of zero hardness, while with the lime-soda process there ordinarily remains a hardness of at least 2°. The base-exchange automatically adjusts itself to variations in the hardness of the incoming water and no precipitate is formed. It can be operated under pressure and thus avoids the re-pumping sometimes required in the lime-soda process. There are no moving parts such as are usually employed in the lime-soda process. It also occupies much less space than a lime-soda plant softening the same amount of water.

The disadvantages of the base-exchange process are that it cannot be used for turbid, ferruginous and acid waters. The suspended matter in turbid waters is deposited on the surface of the material, which consequently loses its activity. Ferruginous waters may cause a deposit of ferric hydroxide on the surface of the material or cause the irreversible substitution of iron for sodium in the zeolite. Acid water may act by the irreversible substitution of hydrogen or sodium, and in addition alumina and silica may be dissolved out of the base-exchange material.

An important point with regard to water softening for drinking water supply is that the presence of sodium bicarbonate, the feature of temporarily hard water softened by the base-exchange process, does not appear to accelerate the corrosion of iron supply pipes at ordinary temperature.

In base exchange, the exchange of one base for another is stated never to be complete, but proceeds until an equilibrium depending on the concentrations of the bases in solution is established. According to one school of thought, base exchange is considered to be a heterogeneous chemical reaction governed by the law of mass action. Another school regards it as an adsorption process, kations being adsorbed from the salt solution and equivalent kations expelled from the gel of alumino-silicic acid.

The following facts are now accepted: (1) The equilibrium is a true one and can be established from both sides; (2) the exchange of bases is by equivalents; the anion does not enter into the exchange process.

The Board state that although there is a good deal of general information about the process there is little knowledge of the mechanism of base-exchange from the physico-chemical point of view. Arrangements have

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accordingly been made for an investigation of the process at the Chemical Research Laboratory at Teddington. The investigation is now in progress and many experiments have been already carried out on treated minerals and manufactured zeolites. Sir Alexander Houston has also conducted experiments designed to ascertain whether there is any change in the bacterial population of water as a result of treatment by the base-exchange process.

As regards the activated sludge process the Board consider that this process, the de-watering of sludge and the production of gas from sewage, or sewage sludge, present problems in special need of investigation. They think it is a matter for debate whether the activated sludge process is mainly biological or physico-chemical and believe that the biological aspect offers the more promising line of advance. They have accordingly made arrangements for an investigation of the process on biological lines to be carried out at the London School of Hygiene and Tropical Medicine under the immediate direction of Professor W. W. C. Topley, F.R.S.

THE ANTISCURVY VITAMIN IN APPLES.

THE Medical Research Council have just issued a report undertaken to determine the presence of vitamin C in apples. The object of the investigation was to ascertain the vitamin content of the various apples on the market and to determine the relation, if any, between the vitamin value and breed of fruit, character of soil, age of tree and season. The principal result has been the discovery of the correlation of vitamin value and a particular breed. The English cooking apple (Bramley's seedling) has been found to have a very high content of vitamin C. Although vitamin C is very easily destroyed when heated in contact with air, it appears that there is little loss of the vitamin when the apples are cooked in their skins.

At present the only means of determining the vitamin C content of a food is by feeding guinea-pigs on a diet devoid of the vitamin but abundant in other respects. The determination is laborious and very expensive, and though much experimental work has been devoted to the anti-scorbutic vitamin by Dr. Zilva, no reliable means of estimating the vitamin C content of a food except by animal experiment has yet been discovered. As a result of the present investigation, Dr. Zilva and his co-workers have come to the following tentative conclusions :—

(1) Of a number of apple varieties tested for their antiscorbutic potency, the Bramley's seedling was found to be decidedly more active than all the other varieties, which differed among themselves comparatively very much less in their vitamin C content. There were no indications that the character of the soil or the age of the tree or season had any effect on the antiscorbutic activity of the apple.

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(2) Bramley's seedlings picked from the same tree fourteen days before the normal crop were approximately of the same antiscorbutic value as those of the normal crop.

(3) There was little loss of the vitamin C content of apples stored at 1° C. in the air or at 10° C. in a mixture of carbon-dioxide, nitrogen and oxygen for about three months. The gas-stored apples showed, however, a definitely greater deterioration in the vitamin.

(4) Tests carried out on a number of imported dessert apples showed that the activity was higher in those cases in which the time elapsing between the picking of the fruit and the testing was the shortest. There was no indication of any very marked difference in activity which could be correlated with difference in variety.

(5) The heating of Bramley's seedlings in their skins hardly affected their antiscorbutic activity.

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Clinical and other Notes.

A CONSIDERATION OF TWO CASES OF CERVICAL RIB.

By Major A. G. BIGGAM, O.B.E.,
Royal Army Medical Corps.

The following two cases of cervical rib were seen in the Out-patient Department within a few days of each other and their examination revealed certain points of interest:—

Case 1.—M. H., male, aged 35, complained of burning himself from time to time on the inner side of the left hand by coming in contact with hot objects, no pain being experienced during the occurrence of these burns, the injuries only being discovered some time afterwards.

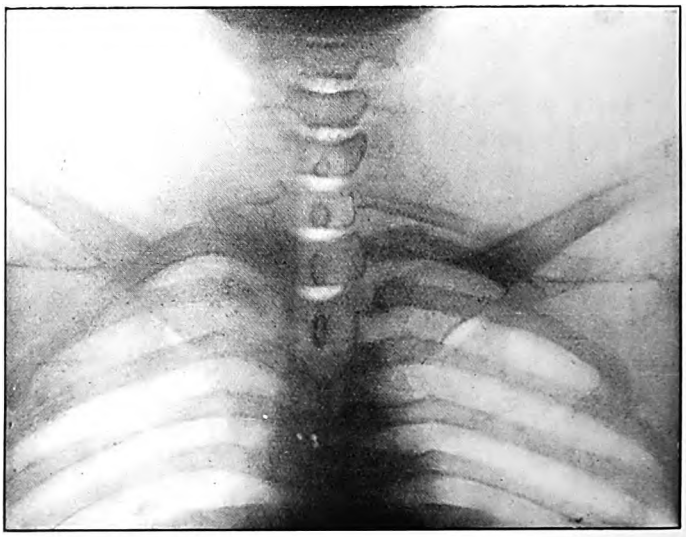


Fig. 1.—Case 1, showing long cervical rib producing only limited sensory changes.

The history of onset of the trouble was that seven months ago he began to feel numbness along the inner border of the left hand, two months later he discovered that this part of his hand had no feeling and that he occasionally burnt himself without realizing at the time that he had done so. Two months ago he began to experience pain in the ulnar groove at the elbow and shooting down to his little finger.

He had consulted a doctor about the disability and the doctor, after examining him, considered that there was some thickening of his left

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ulnar nerve at the elbow and that the pain and loss of sensation might possibly be due to this nerve change.

Shortly afterwards, he was seen by another doctor and examined for leprosy; no signs of this disease could, however, be detected apart from the slight thickening of the ulnar nerve; a nasal smear examination proved negative for *B. leprœ*.

On examination in the Out-patient Department, scars, the result of burns, were seen on the ulnar side of the left hand and lower part of the forearm. No signs of muscular wasting were detected and the power in the hand was found to be unimpaired.

The ulnar nerves were very easily palpated at the inner side of the elbow on both sides, but not more so than might be found with a healthy nerve. Tests for sensation showed complete loss for all forms of sensation in the little and ring fingers and ulnar side of the hand and forearm extending as far as two inches above the wrist.

Inspection above the clavicle showed a marked fullness in the left supraclavicular fossa, and palpation in this region revealed this to be due to the presence of a hard fixed bony structure, almost certainly a cervical rib. X-ray examination confirmed this diagnosis, a long extra rib being demonstrated by this means.

The cause of the sensory disturbance experienced in the hand having been explained to the patient, he returned to his ordinary occupation happy that he was not suffering from a more serious disease and determined to avoid as far as possible injury to his hand from burning.

Case 2.—A. A., male, aged 30, attended at the Out-patient Department complaining of weakness, wasting and deformity of his right hand.

He stated that two years ago he first began to notice that the fingers of his right hand could not be separated properly, and that this hand appeared wasted compared with the left.

One year later, numbness and tingling were noticed in the ring and little finger of his right hand and neuralgic darting pains were experienced in the ulnar border of the same hand and forearm.

On examination his right hand showed marked atrophy of the thenar and hypothenar eminence, dorsal and plantar interossei, and adductor muscles of the thumb. The ring and little finger showed hyperextension at the metacarpo-phalangeal joints and flexion at the interphalangeal joints due to paralysis of the two inner lumbricales.

Movements of adduction and abduction of the fingers in this hand were markedly impaired and the power of opposing the thumb and fingers was decidedly weak. Slight atrophy in the flexors of the forearm was present. Sensory tests revealed loss of all superficial sensations in the little finger and ulnar border of the right hand.

The nasal mucous membrane appeared normal, the ulnar nerve was not thickened and no signs of leprosy could be detected.

The left hand and arm showed no abnormality. No swelling of tumour

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could be detected in either supraclavicular fossa. A cervical rib was suspected as being the cause of the condition and a radiological examination revealed the presence of a short extra rib on the right side.

COMMENTARY.

From a consideration of Case 1 it will be seen how important it is to make a general survey of a patient. Had this been done in the first instance and the supraclavicular region inspected even from a distance, an obvious swelling would have been apparent and palpation would then have determined its bony consistency.



FIG. 2.—From Case 2, associated with a very short cervical rib. Photograph of patient's hands showing marked wasting of the small muscles of the right hand and hyperextension of the ring and little fingers; the area on the ulnar side shaded in black is that of complete anæsthesia.

A comparison of the two cases also shows what a wide variation of symptoms may be produced by cervical ribs. In Case 1 the rib was a large prominent one, but the symptoms were very slight, showing only a limited area of anæsthesia on the ulnar side of the hand. That a large extra rib may be present without producing any symptoms at all is well known, the shape and direction of the rib being more important than the size, one growing directly outwards and so very apparent on palpation in the supraclavicular fossa, being not as liable to cause plexus pressure symptoms as a rib growing downwards and forwards into the posterior triangle of the neck, this type being also less obvious on radiological examination.

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Case 2 illustrates the type with very little bony change visible even by X-rays, the pressure causing the brachial plexus symptoms being produced chiefly by the fibrous band passing forward from its tip to be attached to the sternum or first rib. It is this type of short extra rib and fibrous band that most frequently produces marked pressure symptoms; in this case the resultant marked wasting in the right hand is very apparent in the photograph.

The variations in the site of the origin of the nerve roots entering into the composition of the brachial plexus also often influence to a very considerable extent the symptoms produced by a cervical rib. The usual roots taking part in the formation of the plexus are cervical V, VI, VII, VIII and dorsal I, but sometimes fibres are received from cervical IV root with little or none from D I; this type is called a prefixed plexus and being situated higher up may allow of the presence of a large extra rib without the production of any pressure symptoms on the plexus.

On the other hand when the IVth cervical root takes no part in the formation of the plexus, the branch from the thoracic I is large, and thus may even be a branch from the second thoracic root. This type of plexus, known as a post-fixed plexus, being situated relatively low down may easily become pressed on even by such a short bony structure as a long VIIth cervical transverse process, or the fibrous band uniting its point with the first rib; in such a case little or nothing to account for the pressure symptoms may be revealed on physical or radiological examination; the suspicion that the symptoms are due to bony pressure on the lower roots of the plexus can, however, usually be strengthened by the marked relief obtained from elevating the shoulder on the affected side.

KERATODERMIA BLENNORRHAGICA.

By Major R. H. C. PRYN,
Royal Army Medical Corps.

A case of this rare disease having occurred in the British Military Hospital, Maymyo, it may be of interest and practical value to readers of the Journal to describe the condition and the case for comparison.

Graham Little [1] states that the disease is rare, but it is probable that many cases have escaped recognition, and that as attention is directed to it, more instances of this important affection will be reported. In 1918, three cases only had been described in America, whilst Brown and Hargreaves [2] found three cases in a series of 20,000 cases of urethritis investigated.

The three cardinal symptoms of the syndrome are urethritis, arthritis, and keratosis, usually appearing in that order, and it is said that there is

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usually a history of repeated attacks of gonococcal urethritis before the skin symptoms develop, and in some cases the urethritis had ceased a considerable time before the keratosis developed. Symptoms of severe toxæmia, which are usually present besides the skin eruption, include cachexia, especially muscular wasting, and moderate but prolonged fever, whilst the heart is frequently affected by myocarditis, endocarditis, or tachycardia. Eye complications, severe anæmia and testicular disease are also common complications.

The keratosis, as described by Graham Little, takes two forms in the great majority of cases: (1) Waxy, horny yellowish cones, and (2) a carapace-like hardening of a considerable portion of skin, usually the soles of the feet, but sometimes on the hands and elsewhere. A third variety of lesion, by some believed to be a precursor of the other types, is a vesiculo-pustular lesion, but this has been observed in only a few cases. Gonococci have only once been demonstrated in the skin lesions, but the reaction to specific vaccine therapy confirms the gonococcal causation of the eruption.

The treatment recommended is: (1) the usual local treatment of the urethritis; (2) treatment of the joints by tapping, hyperæmia, etc.; and (3) vaccine therapy, which is so successful as to render the prognosis of this severe affection unexpectedly good. Some recommend small doses at short intervals, starting with half a million and working up to 10 millions, and others start with 50 to 100 millions, with a weekly increase up to 1,000 millions or more. An autogenous vaccine should be used if possible, but a stock vaccine is almost as effective.

The Case.—Pte. R., 2nd Manchester Regiment, paraded sick, complaining of pain in the left foot and fever, and was detained on July 7, 1929. During the night his left knee became acutely swollen and painful and he was admitted to hospital on July 8.

On admission, his temperature was 101·4° F., pulse 76. The blood examination was negative for malaria. A search for the cause of the arthritis, which had the typical appearance of a gonococcal joint, revealed a thick purulent gonococcal discharge from the urethra. Both ankles and feet were swollen and painful, especially the left, the swelling having the appearance of a fascitis. The heart and lungs were normal and there was no splenic enlargement. He stated that he first noted the discharge on July 7, 1929, after connection on July 2, but that he had had pain in his left foot for about three weeks. As he had concealed the discharge, little reliance can be placed on his statement.

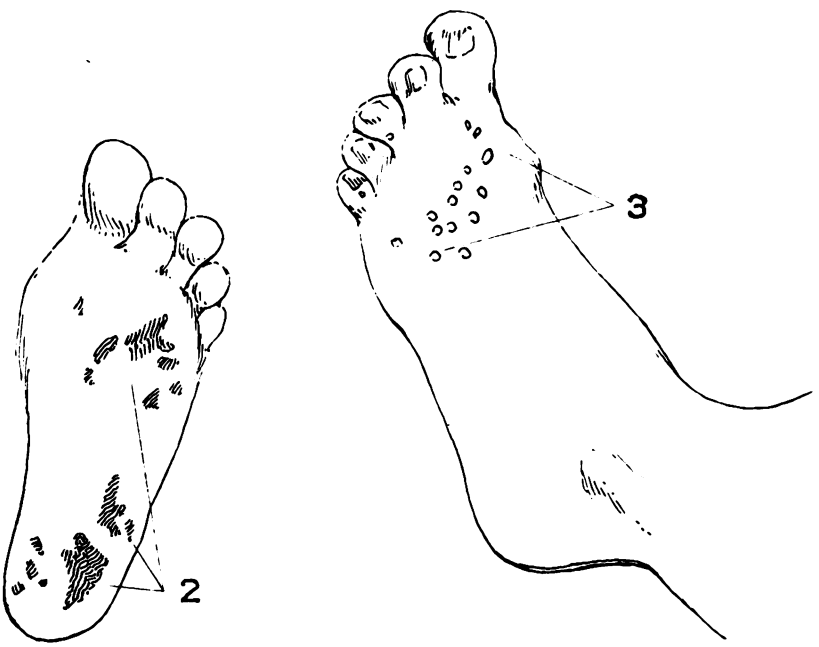
The treatment adopted was: (1) Routine treatment of the urethritis; (2) local treatment of joints by rest, heat, massage to muscles, and slight passive movements and general treatment by a mixture containing sodii sal. and pot iod.; and by sulfarsenol.

On July 18 the left knee was greatly improved after aspiration on July 17, when a large quantity of sterile turbid fluid had been withdrawn. There was some cardiac irregularity with a hæmic murmur, and several

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small pustules were noted on the dorsum of the left foot over the position of maximum swelling.

On July 22 his general condition was worse, but the condition of his left knee was greatly improved, also that of his right knee, which had also become involved. He was markedly wasted, looked toxæmic, and there was great cardiac irregularity with very frequent extra-systoles, occurring on an average once in four beats. Fever ranged between 99° and 102°. Several small browny-yellowish patches of densely hard skin were noted on the sole of the left foot; some of these were situated on the dorsum of the little toe and took the form of small, hard, cone-shaped projections. It was on this day that there occurred one of those coincidences which



appear to be sent expressly by a beneficent Providence to guide our faltering steps. In the British Military Hospital lie a number of derelict old Medical Annuals, which it was my custom to utilize for beguiling the hour when worshipping at the throne of King Ghuzl Khana. On this occasion the 1918 volume caught my eye and fell open at a remarkable coloured plate of a fearsome-looking foot, which I read to be "Keratodermia Blennorrhagica (Captain Crawford Lundie's case)." I read the accompanying article by E. Graham Little, M.D., F.R.C.P., and realized that my case was an early one of the fearsome condition illustrated.

The contents of the vesicles, which by this time were inclined to dry up, were examined for gonococci with a negative result and vaccine treatment by the small dose method was started on July 25. Alkaline baths

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and occasional moist applications to the foot were also adopted, as recommended in the article, but the sole of the foot quickly became a slimy, sodden mass under this treatment and spirit applications were substituted on July 27, and were found to be far more satisfactory.

The condition of the foot on July 29 was as illustrated on the preceding page:—

The drawings of the left foot show:—

(*a*) Swelling of dorsum of foot.

(*b*) The three characteristic forms taken by the skin lesion.

(1) Waxy, horny, yellowish cones.

(2) Carapace-like hardening of a considerable portion of skin.

(3) Small pustules (now dried up). This lesion is said to be rare, but is believed by some to be a precursor of the other forms. It was not the case in this instance, as it was the first lesion to appear, and dried yellowish scales of no particular hardness alone remained to mark the site of the pustules.

The heart condition quickly improved under vaccine therapy, though mild fever continued for seventy days from admission, and it was some time before he began to gain weight. The knee-joints also soon recovered, but the keratodermia was more resistant and even spread for a little while, patches appearing on the sole of the right foot. There were, however, signs of improvement on September 5, the plaques becoming smaller and some showing signs of separation.

By October 5 the keratodermia was cured, though both feet were still swollen and painful, and there was much limitation of movement of both tarsal and ankle-joints. After two and a half courses of vaccine all active signs of disease had disappeared, and on December 26 he was invalided home on account of stiffness of the left tarsal joints which, however, was improving daily under massage and exercises. He regained full movement of all the other affected joints.

In this article I have quoted from the splendid description of the condition by E. Graham Little in the Medical Annual of 1918, and it will be seen that this case furnishes an excellent and typical example of the condition. My thanks are also due to Lieutenant-Colonel J. P. Lynch, R.A.M.C., of the British Military Hospital, Maymyo, and Colonel J. W. West, C.M.G., K.H.S., A.D.M.S., Burma District, for permission to publish this case.

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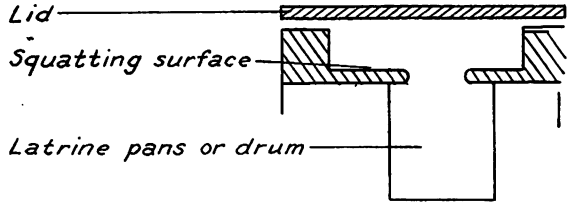
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FLY PROOFING INDIAN LATRINES.

By Lieutenant-Colonel H. H. KING,
Indian Medical Service.

I should like to congratulate Major H. Horan Brown on his neat and simple idea of using a lid actuated by a wire and stirrup for Indian latrines as described in the Journal for March, 1930. In order to assist its general adoption, I should like to describe a small modification, designed to prevent fouling of the lid which is likely to occur from the careless use of latrines, which is so common and involves fouling of the sides or squatting surface. The idea is to let the surface on which the lid rests be outside and about 6 in. above the squatting surface. Thus a vertical section from side to side would present the following appearance :—



If, as is often the case in civilian latrines, a latrine drum is used which is removed from underneath the latrine through an opening in the rear, then this opening would also require a lid unless the drum fits closely under the latrine squatting surface, which is unlikely.

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Travel.

EASTWARDS HOME FROM INDIA.

By Major L. B. CLARKE,
Royal Army Medical Corps.

The middle of the five-year Indian tour usually provides opportunity for that much anticipated home leave which comes as a mental and physical change from the routine of life in the East. How many avail themselves to the full of the period allowed "ex-India"? The majority direct their thoughts homewards the way they have come out, and from Bombay proceed along the stereotyped route via the Suez Canal. But after all the world is round, and why not go the other way? The Government has already taken one over a very considerable part of the circuit of the globe. To continue eastwards and explore as far as circumstances permit the wonders of the Far East and the New World is the logical outcome. Considerations of time and cost might appear to exclude any possibility of carrying this out, but the organization of world travel is now so excellent that it is practicable to visit the greater part of the Far East and Canada and reach home within seven weeks of leaving India, and at a cost which is by no means excessive.

The best time of the year in which to undertake this tour is that of the late spring or early summer, because proceeding via Canada in preference to the United States one takes advantage of the smaller circumference of the earth at the more northerly level, and at these latitudes the winter is extremely cold. The writer having previously booked through Messrs. Thomas Cook and Son and the Canadian Pacific Railway, started on this journey from Rangoon in the middle of April last year, visiting the various countries at the best season of the year.

The humid heat of Rangoon's hottest month was tempered by a cooling breeze, and the fierce light of a Burmese sun obscured by welcome clouds as the launch dropped down the river on her way to meet the s.s. "Elephanta," anchored in mid-stream in readiness to sail for southern seas. The vague outline of the port, the numerous steamships at their moorings, the scurrying to and fro of powerful little tugs, the never-ending rows of timber rafts, all gradually merged into a picture of haze and uncertainty, and one's eye rested for the last time on the great golden glare of the Shway Dagon Pagoda, now softened by the increasing mist and mellowed by the fading light of a Burmese sunset. The anchor was weighed, the thick yellow mud churned up and the journey commenced.

If one's thoughts at this time were tending to stray far from home they

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were rudely jerked back by a remark made by one's cabin companion, who on reading all the labels announced that he wished that he were going that way, for he lived within a few miles of the destination shown on the address. The strangeness of coincidence was however immediately diverted by the sudden arrival via the open port-hole of a lighted cigarette, which was now actively engaged in burning a pair of pyjamas on which it had come to rest. The immediate removal of the offending flame by the way it had come prevented a serious situation and conversation turned on the general carelesssness of one's fellow-passengers.

The ship chunked her way down alternating reaches of curve and straight, and by midnight approached the pilot brig at the mouth of the river. The pilot was dropped and the ship, turning to meet the Southern Cross, proceeded on her way to Malaya.

The course lay close to the coast and on the port were views of the jungle-clad islands of the Mergui Archipelago, and ever and anon the placid surface of the tropic waters was broken by the silvered scurry of flying fish or the steady rise and fall of porpoises at play.

As so often happens in these parts, our full complement of deck passengers proved somewhat of a complication. It should be remembered that all the shipping companies engaged in Indian coastal trade carry for very small sums great numbers of native passengers who are allotted as much area of deck as is occupied by their bedding. On this occasion we had Hindus and Moslems who beguiled the passing hour by an increasingly hostile discussion on the merits of their respective religions. Matters were at any rate temporarily settled by the sudden expression of a common fear. An Indian gentleman travelling on behalf of a local fair had amongst his personal effects a large female panther with two cubs. During the second night the animal gradually worked the bars of its wooden cage so loose that its shoulder was almost through, and attracted by the prospect of flesh on the grand scale was making every effort to reach the deck passengers. Inquiries revealed the curious fact that none of the ship's officers nor any of the passengers possessed a revolver, and the only solution to a problem of immediate danger was to cast the cage into the sea. It would be interesting to know how the matter was settled financially and whether any compensation was paid.

On the morning of the third day the ship dropped anchor in the narrow strait between the mountain island of Penang and the mainland of the Malay Peninsula. Penang is perhaps the most beautiful of all our eastern settlements; it is certainly one of the oldest and came into our possession as one of the Spice Islands, having been "acquired" in the days of the East India Company by the payment to the ruling sultan of a small annuity. On landing one is offered the free services of an ex-soldier employed by the town to advise visitors on sightseeing, assistance with the short time at our disposal we were glad to accept.

The port of George Town is on the only large area of level ground; the

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remainder of the island consists of a series of tree-covered hills rising to a height of about 4,000 feet. A hill railway takes one to the summit from which a great panorama of sea and mainland can be obtained. Villas and hotels occupy the irregular ground of the summit, and through gaps in the luxuriant foliage can be seen, several thousand feet below, great coconut plantations and many acres of rubber. Winding walks and occasional seats afford in this languorous climate ample opportunity of viewing without exertion endless scenes of tropic beauty, whether of verdant land or shimmering sea, in an island which nature has endowed with a generous hand. In this delightful spot the wealth of scenery is no less the wealth of commerce, for the coconut and rubber plantations and the unending variety of palms all have their market value and are a source of considerable revenue to their owners and to the State.

Lunch at the principal hotel was noteworthy for the fact that having left India we were no longer served with finger bowls, a fact which we noticed throughout the Far East. Here a local resident indicating with tremulous hand the details of Province Wellesley, stretched in vast panormana below, insisted on correcting our pronunciation of the names of certain rubber estates, and would have doubtless improved our local knowledge both of geography and rubber had our time been unlimited and his sobriety unquestioned.

At the foot of the hill railway a taxi ordered by our friend the ex-soldier was in attendance, and in this somewhat antiquated conveyance we were driven for thirty miles round the island. An hour's delay caused by a burst tyre and the absence of a spare wheel which would function threatened to curtail our sight-seeing, but sufficient time was left to complete the circuit of a drive which included the greater part of the palm-fringed coast and a couple of mountain passes of surprising grandeur. A short visit was made on the return to a roadside temple where snakes in stone and snakes in flesh united in immobile welcome. After tea, at a hotel alongside the sea, we watched the sunset from the terrace and with regrets at the shortness of our stay betook ourselves by rickshaw to the station. Penang is unique in that it possesses a railway station complete in every detail save that of trains, for the railway is on the mainland opposite and instead of entering a railway carriage we embarked on a steam ferry. On reaching the mainland we entered the Singapore Express which was waiting, and in a drenching storm of rain our journey was commenced. The railways like everything else in this country are very well run, and after dinner in the restaurant car we turned into our bunks in a small but comfortable wagon-lit.

By 6 the next morning we had arrived at Kuala Lumpur, the capital of the Federated Malay States. Here a great white mosque and the Moslem architecture of the railway station proclaim the religion of the Malay. The distance from Penang to Singapore is about 500 miles, of which about 300 were covered in daylight. From now onwards our way

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was through an endless succession of rubber estates, and we were never out of sight of them till darkness overtook us in the suburbs of Singapore. Mile after mile came views of ordered and carefully kept estates, the trees planted in straight and parallel lines, the ground well weeded and barbed wire and whitewashed stones indicating the boundaries. Now and then a plantation would pass where weeds and rubbish lay thick under foot, and native ownership would be obtruded on one's notice. Station after station of neat stone buildings and lawn-like platforms with grass of an emerald green which show the orderly mind and efficiency of administration of this colony. The names of the stations as we flashed past would recall the list of rubber quotations in the Stock Exchange list in the *Times*, in fact many of the names are the same. All day long, from 6 in the morning to 6 at night, came evidences of this vast industry, and one can well believe that three-quarters of the world's rubber is grown in Malaya, and the number of people must be legion who owe wealth and prosperity to the pioneer enterprise of Sir Henry Wickham and his ship-load of seeds from the Amazon.

Occasionally one saw virgin jungle, that vast vegetative struggle for supremacy where tree and twining tendril obscure the sky and dense undergrowth obstructs the path of man and beast. Further south were clearings of the forest in preparation for new plantations; first the felling of mighty trees and then the burning of stumps and undergrowth before the young trees can start on their seven long years to maturity.

By 6 p.m. with a darkening sky Johore was reached, and in the fading light the express ran over the long causeway with sea on each side and the naval dockyard only hidden by a headland, on to the northern end of the island of Singapore. In a place so essentially associated with shipping one had never visualized an arrival by train, and this was due to the recent completion of the causeway which allows trains from Penang and even far-off Bangkok to run through to the Singapore terminus.

Two days and nights allowed of a fair amount of sightseeing and a visit to the Military Hospital at Tanglin Barracks, where one was welcomed by two officers of the Corps. Singapore has a very attractive setting with many beautiful parks and gardens, fine wide streets and many handsome public buildings. The Further East is suggested by a multitude of native boats in which live thousands of Chinese, and the waterway of a wide stream is almost completely occluded. The population of Singapore is mixed; Europeans of all nationalities are much in evidence. Chinese and Malay compete for predominance, the former coming in large numbers and performing all manner of work, while the latter give up the struggle and retire to village life in the interior. The police are Indian and are kept busy on point duty dealing with an ever-increasing traffic, from the native rickshaw to the European saloon. The shopping centre of Singapore is Raffles Square, named in honour of the great Empire builder

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who, despite continued opposition from home, secured in distant days the possession of this naval and mercantile key to the far East.

The journey onwards was continued by the s.s. "Atsuta Maru" of the Japanese Mail Line, the Nippon Yusen Kaisha, plying from London to Yokohama. The Japanese have little to learn in catering for the travelling public, and many of our own shipping lines could with advantage study their organization and copy their example in providing for their passengers a similar high standard of comfort and luxury. The dining saloon on the first night was a perfect bower of flowers from Java, an Arabian Nights' scene of tropical splendour. The food was European, the cooking French, and there were many Japanese dishes as alternatives. It should be explained that one was generally advised as to which variety of Japanese delicacy was considered suitable for Europeans, and bird's nest soup proved an interesting and palatable experiment.

The ship sailed at sunset from the deep water dock, and very impressive were the views of the harbour and town and the numerous small islands off the coast as we gradually passed to the open sea, and thousands of Singapore lights gradually appeared against a background of red and orange afterglow. For a time our course lay east, and then rounding the tip of the Malay Peninsula, the ship turned her back on the Southern Cross and headed north for the China Sea.

French Indo-China, a passing Chinese junk, dances, an open-air swimming bath were details in a five days' voyage of perfect calm. Perhaps the most interesting event was the ship's cinema which, in addition to the ordinary features of such entertainments, showed several films of Japan which added to one's knowledge of the country and increased one's desire to visit it. Whilst the majority of the passengers were English many nations were represented; one met in the swimming bath the Turkish Minister to Tokyo and was assisted into one's life-belt at drill time by a distinguished Japanese admiral.

Hong Kong, which was reached in the early morning, is too well known to many readers of the Journal to warrant any description. The ship moored alongside the ocean docks at Kowloon and soon afterwards we crossed by ferry to the Island. At this time great numbers of Chinese from Canton and other centres of local warfare had sought the peace and security of British territory, and this influx from the mainland tended to aggravate the already serious shortage of water.

A walk round the chief shopping streets afforded an insight into the dwellings and customs of the Chinese and the great business houses and hotels of the Europeans, and everywhere there was evidence of prosperity. In Hong Kong the curio sellers are easily amenable to bargaining, and it is interesting to note that prices are doubled on the arrival of the luxury liners from America. Fortunately it was an off-day, and the prices of various articles which we purchased were very reasonable.

A bathe at Repulse Bay in beautiful clear blue water in a perfect setting

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of scenery was followed by an adjournment to the hotel for lunch. Here a pleasant surprise awaited one in the chance meeting with an officer of the Corps who promptly issued an invitation to lunch. In the evening, on return by ferry to Kowloon, one was interested in reading the various typhoon warnings and felt thankful that this was not the season. The new Peninsular Hotel at Kowloon had been recommended and it proved the last word in American hotel organization and comfort. A second day spent in rambling round the old streets of Hong Kong added to the impressions of the first, and in the evening we embarked on the Canadian Pacific liner the " Empress of Russia," on the long run to Vancouver. The Empress liners are famed throughout the Pacific, and hold the record in this ocean for size, speed and comfort, and their graceful lines, white hulls and yellow funnels made them the most conspicuous and dignified landmarks in any harbour they visit.

We left Hong Kong at daybreak and gradually felt our way out of the winding channel, steering between great irregular hills on each side. The China coast was followed and vast mountain chains stood out in sombre background against the bright and cheerful colours of the Chinese junks.

In these parts piracy is ever possible, and the Empress liner, as a British mail boat, still carries as far as Shanghai an armed escort of an officer and twenty men. The consequence is that all the wealthy Chinese patronize these boats, and there were in the first class large numbers who had sought the protection of British arms against their more predatory compatriots. The two days' run to Shanghai was, however, devoid of incident. Calm weather and fog, with a colder temperature, were the chief features, and late in the evening of the second day we turned abruptly to port, and with innumerable lights on each side just like that of a street entered the great waterway of the Yangtse Kiang. In the morning the ship was slowly steaming up the muddy water of the Wusung River, and at nine o'clock anchored below the Bund of Shanghai.

The weather was very cold by comparison with Hong Kong, great coats were the order of the day, and for the first time for several years one saw British soldiers wearing serge. Shanghai is a great town with much activity and many nationalities, and many types even of Chinese, all possessed with a sense of ceaseless and hurried movement; or else it was the cold which urged them on. A visit to the British Military Hospital and a renewal of old acquaintances stand out in one's memory, as do also an introduction to the world's longest bar in the Shanghai Club and lunch with one of our officers in the grill room below. The public buildings on the Bund, the Nanking Road, the Racecourse and the Hotel Majestic, all described in detail in the London Press at the time of the occupation, require but passing reference. An interesting day was brought to a close by the arrival on the ship of the various purchases which had been made and an adjustment of one's kit to accommodate them.

Shanghai was left that night and the course set for Japan. In the

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Yellow Sea, aptly named for its colour, somewhat unpleasant corkscrew movement was experienced and one was thankful not to be on a small ship. Two days later daybreak found us in the beautiful land-locked harbour of Nagasaki, and only persistent warnings prevented the snapshotting of many a charming view, for here in Japanese fortified waters no photographs are allowed.

Landing took place in the brilliant sunshine of a Japanese spring, full of life and colour and cheerfulness. A rickshaw ride through the town, conspicuous for its lack of interest, took one to a picturesque park on the side of a hill. Japan is essentially a country of small things, small people, small hills, trees and houses, but many of them. This wonderful semi-artificial park with its diminutive trees and shrubs, its throngs of gaily-dressed people, all in gala attire, for it was a holiday, looked over a great expanse of hilly country, and away in the distance were the blue waters of the bay across which Madame Butterfly looked so long in vain for her expected lover. One soon realized that the vast crowds in their dainty dresses and all the merry little children were heading towards a central rendezvous, and here one found was about to be staged one of the most interesting ceremonies in Japan, that of the Armistice Day for the Russo-Japanese War, a day of more importance to them than that which ended the Great War.

In a wide open space bordered by azaleas and wisterias was set a long altar table with bread and fruit and fishes, and in front were many rows of chairs facing one another across a central aisle, as in the transept of a church. The audience were taking their seats, the Mayor and Corporation in frock coats and silk hats, admirals and generals and other officers in full uniform, soldiers and sailors and Boy Scouts, and a great concourse of civilians. Presently a gong was sounded, the audience rose to their feet, and to the measured beat of unseen drums entered a procession of tall and dignified priests in long white robes and preceded by the chief priest wearing a head-dress like that of the Mikado, in fact the whole scene was Gilbert and Sullivan in real life and its native setting. Various ceremonies were carried out, including the blessing of the bread on the altar and the benediction of the audience, all in truly mediæval style. It was a matter of some satisfaction to have witnessed such an occasion, for nowadays in this land of intense industrialism the picturesque is rapidly receding into the past.

On our return to the town a visit was made to a Japanese tea-house, and here in a gilt and cedar-wood room with paper windows was performed for our benefit the butterfly dance of the smiling geishas, while the audience sat on golden cushions and drank from dainty porcelain cups a foul mixture of acrid green tea.

The next day the "Empress of Russia" was well out to sea, and sailing north to the main island passed over the scene of the Battle of Tsushima where the Baltic Fleet, after its long inglorious journey, fell to the mercy

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of Admiral Togo. In the late afternoon Shimonosiki was passed, and the ship entered the narrow channel forming the entrance to the famous Inland Sea of Japan. The weather was cold and the sky overcast and visibility poor, but close at hand were views of many towns, and here and there quaint rocky islands with Shinto temples. In the morning we were moored alongside the quay at the port of Kobe. Here, by arrangement with the C.P.R., one could leave the ship and proceed by train to Tokyo.

A short rickshaw ride to the station enabled one to catch the Tokyo Express, and at about nine o'clock a 400-mile journey through nearly the entire length of the southern coast of Japan was started in the observation car of a very fast and comfortable train. Many places of interest were passed, including Osaka, the former capital and now a great manufacturing town, Kyoto, famed for its cherry blossom, and Nagoya for its porcelain and pottery. In the afternoon we approached the sea and for many miles ran alongside, winding in and out of beautiful bays with clean white sand, and then leaving the coast the train climbed gradually about a thousand feet up on to a high mountainous tableland close to Fujiyama, now obscured in cloud, and then dropping down to the other side past Alpine scenery on a considerable scale, we encountered tunnels and high bridges alternating in rapid succession, and darkness came on as we approached the outer suburbs of Yokohama.

From here onwards to Tokyo there are four tracks of rails, and electric trains maintain a local service as frequent as in London. The distance is only eighteen miles, and it is almost continuous town, and in this compact urban area lives a population not far short of that of the entire Dominion of Canada.

We reached Tokyo Central Station at about 8 p.m. and proceeded to the Imperial Hotel, the only hotel which stood the earthquake of five years previously. It is an amazing structure. It is difficult to place its architecture. It is certainly not Japanese, but resembles the Assyrian style more than anything else. The architect was an American, and is said to have built the hotel and become mad. Critics reverse this order; however, it is worth visiting Tokyo just to see this extraordinary building. A wide courtyard with a large ornamental pond leads to the entrance, and once inside one is confronted with yellow stucco walls with low ceilings in the same colour and material, twisting corridors with subdued lights where one gets lost, grottoes and sitting-out corners with still less light, and a large low-roofed dining-room of grotesque design with kaleidoscopic chandeliers under which during dinner and dances multi-coloured lights emphasize the bizarre effect. The bedrooms are all decorated with iridescent yellow walls, have cedar-wood furniture and beds and gilt fittings, and the adjacent bathrooms contain sunken mosaic Roman baths. Underneath the hotel runs a street of shops where all one's business can be done, from purchasing oriental curios to sending a cable home.

The next morning a long and interesting tour of the city was carried

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out. Tokyo is largely rebuilt and lofty buildings in the business quarter are a feature of the modern town. The lesson of the earthquakes has been learnt, and nearly all old Tokyo consisting of wooden buildings made of matchwood, an easy prey to earth tremors and fire, has given place to a great new city of ferro-concrete, more ferro than concrete, for the width of the girders is greater than that of the concrete between. Wide avenues are being constructed and planted with double rows of quick-growing trees, and in a short time Tokyo will rival any of the capitals of Europe.

The Royal Palace is situated in a large park in the centre of the town. It is surrounded by a moat, and the main entrance, over an artistic wooden bridge, is guarded by sentries. The palace is old and built of wood. A new one was built a few years ago, a magnificent one resembling Versailles or Fontainebleau, but as its architects could not guarantee that it was earthquake-proof, it was handed over to the Dowager Empress.

Numerous parks with famous temples were seen, all well kept and of great size. Houses of well-known people were passed, that of Prince Chichibu and a small villa occupied by Admiral Togo deserving mention. The shopping centre is the Ginza, an eastern Rue de la Paix, now nearly rebuilt.

The Japanese strike one as being very alert and business-like, and although their skin is of a sallow colour, both men and women have bright pink complexions, and the small babies are living Japanese dolls. The traffic in the streets is considerable, but the motors are few; only one English car was seen and that was a Morris four-seater. The problem of congestion has not yet reached Japan, for the roads are bad and the taxes high.

The next day one was able to see more of Tokyo and then take an electric train to Yokohama. Here the "Empress of Russia" had arrived and was moored with three other large liners to the new quay. The sailing of the C.P.R. boat every three weeks is the chief event in the lives of the English and American residents, and long accounts appear in the two daily English papers. It was at such a time five years previously when the Empress boat had just cast her moorings that the great earthquake took place and a great loss of life occurred amongst the hundreds of people collected on the quay. Yokohama, like its sister town the capital, is almost entirely rebuilt and the public buildings are on a large scale.

At 3 p.m., with bands playing and flags flying and a network of coloured streamers connecting ship with shore, the liner started on her 4,300 miles crossing of the Pacific. In the outer harbour a British cruiser was lying, H.M.S. "Suffolk," which had just conveyed the Garter Mission to Japan.

Out at sea destroyers of the Japanese Navy were passed and in a short time our course was set in a north-easterly direction for the far north of the Pacific. The nearest route from Yokohama to Vancouver is not the straight line drawn on the maps of our school geographies, but, owing to the shape of the earth, a curved line like an inverted bow with the most northerly

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point close to the Aleutian Islands. In this way several hundreds of miles are saved.

Our cargo was chiefly silk, and it is interesting to learn why we should be carrying such a commodity on a fast ocean liner. The reason is this: the chief export from Japan is silk, its destination is New York, it is somewhat perishable and easily damaged. It is therefore carried in the fastest trans-Pacific ships. At Vancouver a special train awaits the incoming liner and starts immediately the silk is loaded. It is the fastest long-distance train in the North American continent, relays of engines being used and all other traffic giving way, and New York is reached in the shortest possible time. Failure to arrive on time entails great loss of money.

A striking insight into international trade is seen in this export of silk. The Japanese are mostly a rice-eating people. Their country is mostly mountainous. Rice grows only in flat country under water. Therefore the greater part of their rice has to be imported. Most of this comes from Burma, and the money required to pay for this is just about equal to that received from exporting silk to New York. The American dollars received by Japan are therefore spent in Burma, and so we all become more or less dependent on one another.

The C.P.R. service across the Pacific is carried out by ships specially constructed for speed. They have four propellers which maintain a speed of twenty knots, and yet so carefully are the ships designed that no vibration nor sound is perceptible at any time.

The great distance is covered in nine days, to be more precise ten actual days, for crossing the 180th meridian of longitude one reaches that part of the world where the day arbitrarily commences and an extra day has to be spent to counteract the continual putting forward of one's watches, and so one passes from the Far East to the Far West. Meridian Day was spent between May 13 and 14, and was celebrated by a fancy dress dance. A wireless home from mid-Pacific traversed the Arctic regions.

The C.P.R. have a very great reputation for looking after their passengers, and the "Empress of Russia" more than upheld the high traditions of a famous line. The cabins are fitted with ordinary beds and are provided with electric radiators, hot-water pipes and hot and cold water. Most of the rooms are fitted with large windows, which open and close with a large brass handle which is kept by the Chinese cabin-boy. In a neighbouring cabin were travelling two ladies, one a firm believer in fresh air, the other equally opposed to it. Each time one went out the other rang the bell for the boy and the window had to be adjusted. After a time this boy always took the handle with him, as he realized that whenever the bell sounded the window would have either to be opened or shut. In the colder days of the North Pacific he was kept busy.

The deck space is of considerable extent, the organization of games is on a big scale and the catering embarrasses one with its extent and variety,

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no less than fifty-two numbered items appearing on the breakfast menu. A Philippino dance band plays during meals and at night there is either a dance or a cinema performance. The latter is a special feature of the line and some interesting and beautiful films were shown of the scenic splendours of the C.P.R. route through Canada.

In the steerage we carried about two hundred emigrants from Manila *en route* to the United States, some being students and the remainder destined for manual labour on the sugar plantations of the South. It was apparent that they were feeling the cold very greatly, for their clothing was only suitable for the tropics, and unfortunately two of them died of pneumonia and were buried at sea. As the bodies were committed to the water flags were lowered, the helm was turned slightly, the engines stopped for fifteen seconds, and the great ship continued on her course.

The ten days passed very quickly, the weather was cold, but the sea calm most of the way, and although so far from land one never had the feeling of distance, and nearly every day there were small migrating birds resting on masts and rigging. A daily paper enabled one to keep in touch with the outer world, and one was thrilled to read of an operation on an ex-boxer's wife and the third divorce and fourth marriage of a high light of Hollywood.

On the ninth day the air underwent that subtle, indefinable change known so well to mariners on the approach of land, and a few hours later there gradually appeared on our port bow the faint outline of snow-capped mountains and, with nearer view, a vast panorama of the Island of Vancouver. Presently a small fishing boat was passed, the first vessel seen since leaving Japan, and by dusk we were within British territorial waters and the long journey of the Pacific was concluded.

Before we were out of bed the next morning, and before even the ship had come to port, letters and cables were brought to our cabins, the first association with home via the West. One was curious to know how they had reached us, and we learnt that they had been brought on board by the pilot. At breakfast time the ship was moored alongside the quay at Victoria, the capital of British Columbia, situated on the southern extremity of the island of Vancouver. Only an hour was available in which to leave the ship, but it was worth while to do so if only to set foot for the first time in the New World, to stretch one's legs and take some photographs. The scene was no longer that of the East, there were no natives thronging the pier, no scenes of oriental colour, but just plain, ordinary looking people such as one sees at home and in a setting which was as English as the people.

The five-hour run through the Strait of San Juan de Fuca and between the numerous islands of this famous passage, with Canada on one side and the United States on the other, was of absorbing interest. Here was none of the diminutive toy-like scenery of Japan, but great mountain chains rose on either hand, and to the water's edge descended hills of no mean size densely covered with giant conifers.

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The C.P.R. organization was again exemplified during this short run, and from Victoria to Vancouver one could do nearly all one's business with the officials who came on board. In the various public rooms were seen Customs' representatives of both Canada and the United States, according to your destination, money changers, telegraphists, officials who would arrange your tour in Canada, book your train, your sleeper, your hotel, your sightseeing tours, book you onwards across the Atlantic, and even take all your heavy kit and bond it through free of charge to your cabin in the steamer at Quebec.

Soon after lunch we entered the narrow waters between the look-out point of Stanley Park on the right and the snow-capped range of Grouse Mountain on the left. Then turning to the right the ship steered towards the new ocean pier which lay at the foot of the small hill on which is built the centre of the great city of Vancouver. All our arrangements having been completed, farewells were made to shipboard friends and to the "Empress of Russia," which had brought us safely on the long journey from Hong Kong. Customs' examination and passport scrutiny took some time, for we were all regarded as immigrants and had to declare on the appropriate forms that we could read and write, had not been previously refused admission to nor deported from Canada, and that we had so much money actually in our possession. The arrival of the Empress liner affords every three weeks a pleasant Saturday afternoon's attraction, and the crowds that watched our departure to the hotel were numerous. It was again very noticeable that here were English crowds with English-looking and English-speaking people, and one could well realize what one had so often heard that British Columbia, and especially Vancouver, are the most English parts of the overseas Empire. Anyway we felt at home, or nearly so.

The Vancouver Hotel is owned by the C.P.R., and from the garden on the roof can be obtained a view of exquisite beauty comparable to Switzerland at its best. After tea a car was hired and the owner driver, an ex-chauffeur from Sussex, spoke in affectionate terms of the Old Country. One was able to drive through a considerable part of the town. Our way was first across a narrow isthmus to Stanley Park, a great natural preserve of wooded hill and valley lying between the sunlit waters of two estuaries. It was spring at its very best, with all the flowering trees and wild flowers of the Old Country, and presently one emerged from the gloom of giant trees to a scene of light and colour in English Bay, where many people were swimming and children playing on the sands.

The residential district is very attractive, lying on Shaughnessey Heights and overlooking the bay. Comfortable looking houses standing in small well-kept grounds, each with a close-cropped lawn and no "party" boundary, afforded evidence of prosperity and good taste. The traffic in the business centre is congested. At one cross-roads a clanging bell gives per-

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mission for pedestrians to cross, and no one is allowed to do so unless the bell is clanging, a safe but extremely noisy proceeding. Here one saw a sign-post pointing south: "Seattle 45, San Francisco 1,110." This is the northern end of the great trunk road which runs from Canada to Texas. Canadians declare it is a "dry" one, Americans retort that it is "wet" at each end.

The town of Vancouver is steadily increasing in size and importance. It is the finest natural port on the Pacific Coast, and its trade in timber and furs and wheat is now promised further expansion through the important discovery of oil in the foot-hills of Alberta.

The following morning was spent in a delightful visit to Grouse Mountain on the other side of the river, a view from its summit of about 4,000 feet including the wonderful ranges of the Selkirks and Rockies, and across the town the northern boundary of the United States. A chalet in Swiss style provides hotel accommodation, and between parallel rows of fir trees could be seen cut out in the deep snow a long ski run and a track for sledges. The latter were each drawn by half a dozen "husky dogs," brothers and sisters of those taken by Commander Byrd to the Antarctic.

(*To be continued.*)

Current Literature.

Pesch, K. L. Ueber den Erreger der Psittakosis. [Ætiology of Psittacosis.] *Muench. Med. Woch.* 1930, v. 77, 484-5. [Hyg. Inst., Univ., Cologne].

The author describes a series of bacteriological examinations carried out with material obtained from five human cases of psittacosis. The material examined during life included sputum, blood and urine. From two of these cases further material was obtained for bacteriological study at autopsy. The results were entirely negative as regards bacilli of the paratyphoid group, or streptococci of the type which have been described in association with this disease. An extensive series of experimental inoculations, using warbling grass parrakeets as test animals, gave results which pointed strongly to the presence of a filtrable virus. In these birds a fatal disease could be produced by the inoculation of material from the human cases, and could then be passed in a series from bird to bird. Careful bacteriological study of the birds which died, by culture and by microscopical examination of the tissues, failed to implicate any bacterium or any spirochæte as the cause of the disease; while in eleven cases it was found possible to transmit the disease from bird to bird by the injection of tissue-extracts which had been filtered through Seitz-filters, or through Chamberland II candles.

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A monk parrot was available for examination, from which one of the human cases had probably been infected. From material obtained from this bird, five warbling grass parrakeets were inoculated, and contracted a fatal disease. From four of these birds the virus was carried to the third passage through other warbling grass parrakeets, by the injection of filtered or unfiltered tissue-extracts.

W. W. C. TOPLEY.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 6.

CHEVASSUT, Kathleen. **The Ætiology of Disseminated Sclerosis.** *Lancet.* 1930, Mar. 15, 552-60, 1 chart & 3 figs. on 1 spec. pl. [26 refs.] [Westminister Hosp., London.]

The introductory part of this paper consists of a brief discussion of the probable ætiology of disseminated sclerosis. The histopathology of the disease, the characteristic colloidal gold reaction of the cerebrospinal fluid, and the demonstration of abnormal curves in lævulose-tolerance tests are cited as evidence suggesting a toxæmic origin.

The bacteriological results (which form the essential and significant part of the author's investigations) may be summarised as follows:—

Using a medium consisting of Hartley's broth (pH 7·6) with the addition of unheated human serum (3 c.c. to 8-10 c.c. of broth), and examining these cultures by dark-ground illumination, appearances were observed with 176 of 188 specimens of cerebrospinal fluid from cases of disseminated sclerosis, which were interpreted as indicating the growth of a filtrable virus. No similar appearances were observed with 269 control samples of cerebrospinal fluid. These control samples were obtained from normal persons and from cases of tabes dorsalis, cerebrospinal syphilis, subacute combined degeneration, transverse myelitis, spinal compression, epilepsy, cerebral tumour and hysteria.

The appearances met with are similar to those which have been described by Mr. J. E. BARNARD in several communications, and the author acknowledges her indebtedness to him for help in this part of her investigation. Colonies, showing a general similarity to those observed with the organism of pleuropneumonia though possessing individual characters of their own, were obtained by the agar-covered-glass-slip method devised by WELCH; and these are figured in a plate.

Other changes occurred in the inoculated media, which were regarded as indicative of growth activities. Thus, the pH of such tubes fell to 6·9 on the 5th-7th day, reverted to 7·6 by the 10th or 11th day, and then passed beyond this point, reaching 7·8-8·0 by the 14th day; while uninoculated tubes, or tubes inoculated with other samples of cerebrospinal fluid, maintained a pH of 7·4-7·6. Tubes to which glucose or mannitol had been added showed a progressive fall in pH, from 7·6 to 6·4-6·5. It is admitted that the presence of the unheated serum introduces a disturbing factor;

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but it noted that the degree of glycolysis in uninoculated tubes never approached that in the inoculated tubes.

These morphological appearances, and biochemical changes, could be reproduced in subcultures. A preliminary series of filtration experiments, using collodion membranes, prepared by the methods described by ELFORD, gave results which suggested that the granular form of the virus could give rise in subculture to the minute spheres characteristic of the developing colonies.

[The real nature of the appearances noted and described can, of course, only be finally settled by further experimental work, and the author is eminently cautious and conservative in her conclusions. It is obvious that her investigations have been carried out with meticulous care, using the best available optical technique, and with the assistance of those who possess unique knowledge and experience of this particular type of work. Whatever the final verdict may be on the significance of these findings in regard to the ætiology of disseminated sclerosis, they have presented new data with regard to the more general problem of the possible nature and cultivation of filtrable viruses].

W. W. C. TOPLEY.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 6.

OKELL, C. C. **The Relationship of Virulent to Avirulent Diphtheria Bacilli.** *J. Hygiene.* 1929, v. 29, 309-12. [5 refs.] [Wellcome Physiol. Research Labs., Beckenham, Kent].

The relation of virulent to avirulent diphtheria bacilli remains one of unsolved bacteriological puzzles. The observations recorded by CROWELL and by COWAN, of the appearance of avirulent variants in virulent strains of *C. diphtheriæ* have not yet been confirmed by other workers; and it would seem that such a change must result from an unusual and uncontrollable mutation, rather than from a variation analogous to the well-known S—R transformation. The author has failed to detect a single avirulent variant among 700 strains obtained by selecting single colonies from subcultures of the Park 8 strain.

The present report brings evidence of another kind, suggesting that virulent strains may give rise to avirulent descendants under natural conditions. In earlier work, carried out in the same laboratories, EAGLETON and BAXTER examined 348 strains of *C. diphtheriæ* by direct agglutination and by absorption. They found that 332 of those strains could be classified in 10 serological groups, while each of the remaining 16 strains constituted a seriological entity. Using the 26 sera which covered all these 348 strains, OKELL (with BAXTER) examined 100 avirulent strains, collected at the same time as the virulent, using the same technique. Only 2 of these 100 avirulent strains could be assigned to any virulent group; nor was it possible to group these strains by sera prepared against 10 of them.

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It would appear, therefore, that a random sample of avirulent strains will probably present a high degree of antigenic heterogeneity, and will show little antigenic relationship to any members of a random sample of virulent strains.

The author had in his possession certain pairs, or sets, of strains, which were in some way associated as regards their source of origin.

Three pairs of virulent and avirulent strains had been isolated at the same time from the throat or nose of the same patient. In one case it proved impossible to determine whether there was any antigenic relationship between the virulent and the avirulent pair, on account of technical difficulties in preparing a satisfactory agglutinating serum. In a second case the virulent strain belonged to EAGLETON and BAXTER'S Type III, while the avirulent strain could not be identified with any serological type. In the third case neither the virulent nor the avirulent strains belonged to any previously identified type; but when tested against their own antisera they proved to be antigenically identical with one another.

There were three pairs of strains, in which the avirulent strain was isolated from the throat or nose of a person who had been harbouring the virulent strain at an earlier date. In the first case a Type IV virulent was followed by an untypeable avirulent, the latter showing no serological relationship with the former. In the second case a Type III virulent was followed by a Type III avirulent. In the third case a virulent belonging to a type not previously identified was followed by an avirulent which was shown to be antigenically identical with it.

There were 13 virulent and 15 avirulent strains which showed epidemic association, in that they had been isolated from different patients during the course of the same epidemic. Of the 13 virulent strains, 4 fell into Group VII of EAGLETON and BAXTER and of the 15 avirulent strains 7 fell into this group. In the same epidemic 2 further virulent strains fell serologically into a single group, which did not correspond to any previously identified; 5 avirulent strains were found to fall into this same group.

As the author points out, the previous experience with random samples renders it highly improbable that these relations between the associated strains rose by chance alone. There is an obvious suggestion that, under natural conditions, virulent diphtheria bacilli occasionally give rise to avirulent variants, possessing the same bacterial structure.

W. W. C. TOPLEY.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 6.

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Reviews.

THE CHINESE MEDICAL DIRECTORY. Second Edition. Shanghai National Medical Association of China. 1930.

This publication is symbolical of the modern spirit of progress in China. Its scope may be indicated by a quotation from the preface: "To give a brief outline of the health organizations in the Capital and in Shanghai, to give a concise but connected story of the most important medical institutions in Shanghai, to supply additional information about medical institutions in China in a tabulated form, and to correct outstanding errors so far noticeable in the first issue, represent the aims of this edition."

The book, which contains some 400 pages, is printed partly in English and partly in Chinese. The curricula of some of the teaching institutions are given in some detail, and it is interesting to note that time is allotted to the study of English and German. An "incomplete list of hospitals" is followed by a list of Chinese medical practitioners. The volume concludes with, in English, "A list of tentative regulations to govern medical practitioners in China."

HANDBOOK OF THE VACCINE TREATMENT OF CHRONIC RHEUMATIC DISEASES. By H. Warren Crowe, D.M., B.Ch.Oxon., M.R.C.S., L.R.C.P. London: Humphrey Milford. Oxford University Press. 1930. Pp. viii + 52. Price 2s. 6d.

The author claims that he has studied the treatment of rheumatic diseases by means of vaccines for twenty years, and this handbook summarizes the practical application of his method according to his latest technique. He considers that most of the ailments which are commonly classed as chronic rheumatism are due to bacterial infection, and his experience leads him to the conclusion that the responsible bacteria are a number of strains of non-hæmolytic streptococci and certain staphylococci. Treatment with stock vaccines prepared from these organisms is advocated and the author claims that his results at the Charterhouse Rheumatism Clinic have far exceeded his most sanguine anticipations. The point particularly stressed throughout the book is the regulation of dosage and the failure of vaccine therapy in other hands is attributed largely to indiscriminate and excessive doses. Dr. Crowe gives clear and logical indication for increase or decrease of dosage based on the information which can easily be elicited from the patient during his or her weekly visit to the clinic. Full details of the treatment are given, including schemes for the keeping of records.

The book is written in a straightforward, lucid style, and should be of interest both to the general physician and to the exponent of vaccine therapy.

C. J. C.

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COLOUR VISION TESTS. By Professor Oscar Oblath. International Labour Office: Studies and Reports. Series F. (Industrial Hygiene) No. 12, London: P. S. King and Son, Ltd. 1929. Pp. 48, five coloured plates. Price 2s.

Published for the International Labour Office, the tests here collected are the most useful and practical methods for examining the colour sense.

It is a fascinating subject, dealt with from the practical point of view, and there is a wealth of information in very small compass.

Chapter I is, in summary form, a lucid description of what is meant by colour sense and the various anomalies that are of so great practical importance. Chapter II discusses the importance of colour sense in certain occupations, and the problems that arise. Chapter III describes shortly various methods for testing the colour sense, and the scientific ingenuity involved makes very interesting reading.

Holmgren's wools are used in the Army for testing candidates for commissions, and it is interesting to find that this old method is still used in many countries. A much better method is the Ishihara test, consisting of coloured diagrams based on confusion colours. The diagrams are published in book form and the test is simple and reliable, and admirably adapted for rapid examination. It should certainly replace the coloured wools which, Professor Starling says, are now mainly of historic interest. It is unfortunate that Parson's lamp is not mentioned, as it is one of the best scientific methods in use.

If reliance is to be placed on coloured signals for the regulation of traffic, this little book should be studied by the medical profession, for roughly five per cent of the male population have defective colour sense.

Professor Oblath is an expert on his subject, and he is to be congratulated on a valuable piece of work.

R. M. D.

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VOL. LV. NOVEMBER, 1930. No. 5.

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Journal
of the
Royal Army Medical Corps.

Original Communications.

THE TESTING OF IMMUNITY.

BY MAJOR N. T. WHITEHEAD, M.C.,
Royal Army Medical Corps.

ONE of the difficulties in connection with the production of a consistently good prophylactic vaccine lies in the fact that in most cases there is no reliable method of testing the degree of immunity conferred by its administration. After many years, sufficient statistical evidence has been collected to make it incontrovertible that the British Army anti-typhoid vaccine produces a very definite degree of protection, but if more precise laboratory data regarding its immunizing effect were available it would tend to make the production and employment of this type of vaccine less empirical than it is at present.

The following are some of the queries that still remain unanswered :—

(1) Is there a variation in the immunizing properties between different strains of the same organism ?

(2) Is a virulent, recently-isolated organism to be preferred to one that has been frequently subcultured ?

(3) Is a strain which grows in somewhat rough-surfaced colonies less efficient than one whose colonies are quite smooth ?

(4) Does a vaccine lose its immunizing properties in course of time ?

(5) Does heat have any effect upon it ?

The early workers on this subject were inclined to attach more importance to the presence of agglutinins as a means of measuring immunity than would now be admitted. That well-marked immunity can be induced

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without the development of a significant amount of floccular or granular agglutinins in the blood has been amply demonstrated on several occasions. (Webster 1924, Topley 1929, Schutze 1930, Whitehead 1930.)

Failure to find some indirect method of measuring immunity has resulted in greater attention being paid to the direct method involving the use of animal experimentation, and lately work has been carried on in the Vaccine Department of the Royal Army Medical College with a view to evolving some trustworthy test on the lines suggested by Professor Topley's epidemiological work with mice, which is to be found in the *Journal of Hygiene*, vols. 19 to 23.

The general idea of the work has been to employ an organism of the same group as *B. typhosus*, which is pathogenic to mice in much the same way as the typhoid bacillus is to man, and with it to produce prophylactic vaccines of varying immunizing powers which can then be tested by direct animal experimentation. If this animal experimentation is found to demonstrate the immunity which has been intentionally produced in groups of experimental mice it will then be permissible to employ it in an endeavour to answer the queries already mentioned.

The organism chosen was *B. aertrycke* (Mutton), on the grounds that it produces a natural infection in mice characterized by a general septicæmia of not too violent a character and an inflammation of the intestines with excretion of the organism in the fæces. Unfortunately, it has been found almost impossible to produce a solid immunity against a known lethal dose of the organism, and this difficulty has been encountered by other workers (Schutze 1930). In consequence, it has been necessary to use batches of mice and to measure the immunity by the total number of days over which a batch of mice survived a test dose of living organisms compared with the survival period of the same number of unprotected mice. The method of estimating the life of a batch of mice was to sum the individual lives. Take, for example, batch C in Experiment V :—

4	mice	lived	3	days, giving a total of	12	days
3	mice	lived	4	days, giving a total of	12	days
9	mice	lived	5	days, giving a total of	45	days
2	mice	lived	7	days, giving a total of	14	days
1	mouse	lived	8	days, giving a total of	8	days
1	mouse	lived	9	days, giving a total of	9	days

The batch life in this case would then be 100 days

The mice that remained alive on the last day of the experiment were considered to have died on the following day.

Having chosen a suitable organism the next thing to do was to be able to produce at will at least two grades of immunity amongst the experimental mice. These two grades of immunity would then form the test by which to estimate the accuracy of animal experimentation in demonstrating the degree of immunity.

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EXPERIMENT I, IN WHICH AN ATTEMPT HAS BEEN MADE TO REDUCE THE IMMUNIZING PROPERTIES OF A VACCINE BY HEATING IT TO 100° C. FOR ¼ HOUR.

Vaccine Dosage. 50 million and 100 million at 6 days' interval.
Test Dose. 10,000 living organisms given intraperitoneally 8 days after last dose of vaccine.

"A" batch comprised 20 mice given vaccine heated to 54° C. for 1 hour.
"B" ,, ,, ,, ,, ,, ,, 100° C. for ¼ hour.
"C" ,, ,, ,, ,, no vaccine.

Number of days after test dose	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Remaining	Total number of days lived
Deaths in A batch									1	—	1	1	1	1	1	2	2	1	1	1	—	1	--	6	343 A batch
Deaths in B batch						2	1	—	1	2	1	1	1	—	1	—	1	1	—	1	—	—	—	7	302 B batch
Deaths in C batch						6	3	3	2	1	3	—	—	1	—	—	—	—	—	—	1	—	—	0	157 C batch

EXPERIMENT II, IN WHICH AN ATTEMPT HAS BEEN MADE TO REDUCE THE IMMUNIZING PROPERTIES OF A VACCINE BY HEATING IT TO 100° C. FOR ½ HOUR.

Vaccine Dosage. 50 million, 100 million and 200 million at 7 days' interval.
Test Dose. 10,000 living organisms intraperitoneally 20 days after last dose of vaccine.

"A" batch comprised 20 mice given vaccine heated to 54° C. for 1 hour.
"B" ,, ,, ,, ,, ,, ,, 100° C. for ½ hour.
"C" ,, ,, ,, ,, no vaccine.

Number of days after test dose	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Remaining	Total number of days lived
Deaths in A batch						1	1	—	1	—	—	—	3	1	2	—	—	2	—	—	1	—	—	8	334 A batch
Deaths in B batch							1	2	1	—	—	—	1	1	1	1	1	—	1	—	—	—	1	9	345 B batch
Deaths in C batch				1	2	—	2	1	2	—	3	2	—	3	—	2	—	—	—	—	—	—	—	2	213 C batch

EXPERIMENT III, IN WHICH AN ATTEMPT HAS BEEN MADE TO PRODUCE A VACCINE OF REDUCED EFFICIENCY BY MAKING USE OF THE "ROUGH" FORM OF THE ORGANISM.

Vaccine Dosage. 100 million, 200 million and 300 million at 9 days' interval.
Test Dose. 20,000 living organisms intraperitoneally 21 days after last dose of vaccine.

"A" batch comprised 28 mice given a vaccine made from a "Smooth" form.
"B" ,, ,, ,, ,, ,, ,, ,, "Rough" ,,

Number of days after test dose	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Remaining	Total number of days lived
Deaths in A batch							1	—	1	1	2	1	1	1	2	1	1	1	—	—	—	2	1	12	495 A batch
Deaths in B batch			1	—	—	2	1	1	—	1	1	2	3	2	1	4	1	—	2	—	—	—	—	6	392 B batch

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EXPERIMENT IV, IN WHICH AN ATTEMPT HAS BEEN MADE TO REDUCE THE IMMUNIZING POWER OF A VACCINE BY STORAGE AT ROOM TEMPERATURE.

Vaccine Dosage. 100 million and 200 million at 7 days' interval.
Test Dose. 10,000 living organisms intraperitoneally 15 days after the last dose of vaccine.

"A" batch comprised 20 mice given vaccine heated to 54° C. for 1 hour and stored at room temperature for *2 weeks.*
"B" batch comprised 20 mice given vaccine heated to 54° C. for 1 hour and stored at room temperature for *21 months.*
"C" batch comprised 20 mice given no vaccine.

Number of days after test dose	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Remaining	Total number of days lived
Deaths in A batch							3	—	—	—	1	—	2	1	—	—	1	—	—	1	—	1	—	10	351 A batch
Deaths in B batch			3	—	—	5	1	—	2	1	—	—	1	3	—	—	1	—	—	—	—	—	—	3	198 B batch
Deaths in C batch			4	3	3	—	1	3	—	1	2	—	—	1	—	—	—	—	—	—	—	—	—	2	144 C batch

EXPERIMENT V, IN WHICH AN ATTEMPT HAS BEEN MADE TO REDUCE THE IMMUNIZING PROPERTIES OF A VACCINE BY HEATING IT TO 100° C. FOR 1 HOUR.

Vaccine Dosage. 50 million, 100 million and 200 million at 7 days' interval.
Test Dose. 10,000 living organisms intraperitoneally 10 days after last dose of vaccine.

"A" batch comprised 20 mice given vaccine heated to 54° C. for 1 hour.
"B" ,, ,, ,, ,, ,, ,, 100° C. for 1 hour.
"C" ,, ,, ,, ,, no vaccine.

Number of days after test dose	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Remaining	Total number of days lived
Deaths in A batch						1	2	1	—	1	1	1	—	2	2	1	—	—	1	—	—	—	1	6	301 A batch
Deaths in B batch				1	1	4	1	1	1	1	2	1	1	1	1	1	1	—	—	—	—	—	—	2	204 B batch
Deaths in C batch				4	3	9	—	2	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	0	100 C batch

One grade of immunity would be produced by using as efficient a vaccine as possible, whilst the other would be obtained by using a vaccine whose antigenic properties had in some way been reduced.

Experiments I, II, III, IV and V were undertaken to see how this reduction of immunizing powers of a vaccine could best be accomplished.

Discussion.

The first point that strikes the observer on making a general survey of the protocols of the experiments is the variation in the life of the control batches of mice, though the same amount of test-dose was given in each

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case. The extreme readings vary from a batch-life of 100 days in Experiment V to one of 213 days in Experiment II. It has been suggested that before drawing any conclusions from the experiments the four batches of control mice should first be considered with a view to fixing a "standard-deviation" figure, that is to say, a figure which will represent the extent to which the batch-life of a set of mice may vary from that of another set of mice, due solely to the amount of natural immunity to be found in normal mice. The objection, however, to this method of analysing the data is that one would have to assume a constant virulence of the test dose in each experiment.

The alternative method of interpretation is to allow each experiment to be judged on its own findings, and to be recorded as producing evidence for or against the point at issue. Repeated tests will then cause the evidence to be confirmed or refuted, and a valid conclusion will eventually be formed.

Working along these lines the inferences to be drawn from the experiments are as follows:—

Experiments I and II suggest that no reduction of immunizing powers is caused by heating a vaccine up to 100° C. for half an hour. This confirms the findings of Arkwright (1927) and Schutze (1930).

Experiment III shows that a lower grade of immunity is produced by a vaccine made from the "rough" form than when the "smooth" form is used.

Experiment IV indicates that a vaccine which has been stored at room temperature for about a year and a half will give less protection than a freshly made vaccine.

Experiment V indicates that the immunizing power of a vaccine is definitely reduced, though by no means completely destroyed, by heating it to 100° C. *for an hour.* Schultz (1930) detected a very marked reduction in the immunizing power of a vaccine when it was heated to 100° C. for two hours, so that here again the finding of Experiment V seems to confirm the work of others.

It appears, therefore, that by using a stored vaccine, a "rough" vaccine, or a vaccine that has been steamed for an hour, one is able to produce a lower grade of immunity than is obtained with a normal vaccine, and of these three methods the latter is by far the most suitable. Experiment V would, of course, have to be repeated several times and produce consistent results before confidence could be placed in this method of producing a low-grade immunity.

Now, as regards the production of the higher grade of immunity; the "A" batches of mice in Experiments I, II, IV and V, all received similarly prepared vaccines, though in somewhat different doses. This procedure induced an amount of immunity represented by the figures 2·2, 1·6, 3, and 2·4, respectively, as compared with the figure 1 which represents the natural immunity in each of the corresponding control

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batches of mice. That is to say, the greatest amount of immunity that a normally-made vaccine produced was only three times as great as that found in the control mice.

There are two explanations for these results; either there are so many uncontrolled factors in animal experimentation of this kind that the factor of acquired immunity is more or less obscured, or that the maximum amount of immunity produced is so low, and consequently the range of values so limited, that it is possible to demonstrate little more than that immunity is or is not present.

It is probable that the second of these explanations is the correct one, and before this method of experimentation can lead to any definite results the immunization obtained with unmodified vaccines must be improved. Larger doses of vaccines may be the solution of the problem, though the doses used in these experiments seem to be massive in proportion to the size of the animals. Schutze (1930) gave very much larger doses to his mice in some similar experiments and certainly obtained better protection. Careful consideration of his results, however, suggests that his success may have been due to the use of a much less virulent strain of *B. aertrycke* in his test dose. It might conceivably be easier to protect mice against the comparatively large lethal dose of a semi-virulent strain, as Schutze appears to have done, than to protect them against a minute dose of a virulent strain, as we have attempted in these laboratories. In this connection Wilson's recent article on the recognition of the avirulent colonies of *B. aertrycke* is of considerable interest.

Conclusions.

That in the hands of the writer experimentation with *B. aertrycke* and mice has not so far proved a satisfactory method of solving the problems of prophylactic inoculation. The failure may have been due to the fact that the method of estimating immunity involved too many uncontrollable factors or, what is more likely, that the amount of protection which was produced by the most efficient vaccine was so low as to leave little margin by which gradations of immunity could be distinguished.

Though this investigation has failed in what it set out to accomplish, it is considered that the accumulated data might be of use to other workers, and should therefore be published.

My thanks are due to Professor Topley for his advice on many occasions and to Lieutenant-Colonel Marrian Perry, R.A.M.C., for helpful criticism and his permission to publish this paper.

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CLINICAL COINCIDENCES.

By Major R. PRIEST,
Royal Army Medical Corps.

Many of us who work among human life, its frailties and sufferings, must have observed that unusual and perhaps rare types of cases show a tendency to occur in sequence over a short period of time, and that another case of the same type may not be seen for a very long interval or, maybe, never again in the course of our practice. I thought it would be of interest to describe some such cases, which have been admitted to the Queen Alexandra Military Hospital in pairs, as it were, not only as an illustration of this observation, but because they are types of disease not usually seen in the ordinary hospital routine.

I.—Intermittent Claudication.

Lieutenant-Colonel V. C., aged 46, who had served in India for twenty-eight years, reported in November, 1928, that in the previous August he had an intense pain in the right calf muscle, associated with a feeling of coldness and tingling in the limb, and that since October he had been unable to walk more than one hundred yards without being pulled up on account of severe pain in the calf muscles of both legs. After a rest the pain went off and he could then walk with little or no pain. He had had enteric fever in 1902, occasional malaria since 1907, a gluteal bursa in 1902, tuberculous bursitis with osteitis of left trochanter, for which excision was carried out. Since then his general health had been good. He was not of Jewish extraction, had never had venereal disease, but smoked at least thirty Egyptian cigarettes daily.

On examination, two teeth were found to be heavily infected at the apices. Lungs healthy. The heart was not enlarged, the sounds were distant and feeble, action regular, no bruits heard. Nothing abnormal found in the abdomen.

With the exception of slight but increasing deafness the cranial nerves appeared normal. Abdominal reflexes were present and equal, knee-jerks present, ankle-jerks not obtained, plantar reflexes "flexor." Motor power good. Sensation unaltered over the body, but light touch and pin-prick were disturbed over an irregular area over the feet, especially the right foot. On passing the hand down the legs there was a very appreciable change from warmth to coldness commencing at the junction of the middle and lower thirds of the legs. The brachial arteries were thicker than usual; femoral arteries pulsated equally and normally; popliteal pulsation was less than normal and the vessels felt thick; pulsation was absent in posterior tibial and dorsalis pedis arteries of both feet. Blood-pressure was consistently

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low, averaging 112/60. Urine was sterile, no abnormal constituents. Urea concentration was good. Blood-urea 26 mg. per cent. Blood-count was normal, and the blood Wassermann reaction was negative; X-ray of lower limb vessels showed no calcification. All forms of treatment in the form of massage, radiant heat and diathermy produced no improvement and injections of pituitrin failed to produce any lasting increase in the blood-pressure. On February 4, 1929, peri-arterial sympathectomy was performed upon two inches of the right femoral artery in Scarpa's triangle. This operation produced no immediate good result and the pulsation of the posterior tibial and dorsalis pedis arteries remained absent on palpation. He was discharged from hospital on March 15, 1929, and on March 22, i.e., one week later, a second case appeared.

Major C., aged 42, on arrival in England on leave from India, said that since May, 1928, he had noticed a feeling of heaviness in both legs but towards the end of the year the left leg appeared to be more affected. In the previous December or January (1929), he noticed that after walking a short distance he had pain in his left calf muscles. He described the pain like a constriction or cramp, rather like a too-tightly-bound puttee. After a rest the pain went away and he could resume his walk only to be pulled up again by the pain. If he ambled along he could go about half a mile without any discomfort, but more rapid exertion caused an earlier onset of the pain.

There was a history of trauma to his back some years ago, also of rheumatic pains in the right shoulder. No history of venereal disease. Not an excessive consumer of alcohol, but he usually smoked between forty and fifty Egyptian or Turkish cigarettes a day. He was not of Jewish extraction.

On examination, the tongue was clean, throat appeared healthy, teeth were under suspicion and were being overhauled by his own dentist. No enlargement of any lymph glands noted. Heart appeared healthy and there was no apparent enlargement. No marked thickening of arteries; pulse appeared regular, moderate to low tension. Lungs healthy. Abdomen and spleen not palpable. The arms appeared normal. On inspection of the lower limbs there was some apparent wasting of the left thigh and left calf. Fibrillary twitchings of calf muscles were noted, these were irregular in time and in extent of muscle involved, and were more marked in the left leg. The lower third of the left leg was colder than the right and more clammy or moist to the touch. The internal popliteal pulsation could be well seen behind the right internal malleolus but the pulsation of that artery could not be seen or felt in the left foot, and pulsation in the left dorsalis pedis could not be detected. Pulsation in both femoral arteries in Scarpa's triangle was present. Knee-jerks were present but sluggish, especially the left. Right ankle-jerk present, left sluggish. Plantar reflex was "flexor" on both sides. Sensations appeared to be normal. Joint sense good. Sphincters unaffected. Pupils reacted to light and accommodation.

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Urine : Specific gravity 1010, acid, no albumin, no sugar. Blood examination showed hæmoglobin 90 per cent, red blood-cells 4,880,000, white blood-cells 9,375. Differential count : polymorphonuclears 74 per cent, small lymphocytes 10 per cent, large lymphocytes 5 per cent, eosinophiles 3 per cent, transitional cells 8 per cent. Wassermann reaction negative. Blood-pressure 110/60 mm. Hg. Radiant heat and massage advised and cigarettes to be reduced. He consulted me again on April 8, 1929, when I found that by measurement there was some wasting of the left lower limb, this being half an inch less than the right.

The series of symptoms seen in the above cases is called "Intermittent Claudication," but in itself is not characteristic of thrombo-angiitis obliterans, for they sometimes occur in other conditions in which the blood supply to the lower limbs is lessened.

In the above two cases the periodic lameness is seen to be associated definitely with thrombo-angiitis of the peripheral vessels of the lower limbs. The patients were not Jews, although the disease is more commonly found in that race ; both were, however, males in the middle period of life, both gave a history of excessive smoking of tobacco, but in neither case did syphilis play a part.

As the ultimate outlook for patients with thrombo-angiitis obliterans is so grave, the lesson we learn from these two cases is the importance of examining all patients complaining of cramp or pain in the legs upon exertion, for the presence or absence of pulsation in the peripheral arteries of the limb.

II.—Serratus Magnus Palsy.

Guardsman R. J., aged 19. In December, 1929, he complained of pain in the right shoulder while he was wheeling a heavy wheelbarrow containing rolls of turf. Later, in addition to the pain, he noticed weakness and inability to raise the right arm. On examination, there was only very slight deformity of the right scapula when the arms were hanging by his side, the right shoulder was only very slightly lower than the left, the superior angle of the scapula was displaced a very little upwards and the inferior angle somewhat upwards and inwards. The shoulder blades could be approximated to the mid-line normally. On raising the arm horizontally forwards, the right scapula became winged to a marked degree. There was inability to raise the arm above the horizontal position. There was no sensory disturbance nor any anæsthesia of the skin over the shoulder girdle and the rest of the limb. All muscles of the shoulder girdle reacted well and rapidly to faradism, with the exception of the serratus magnus which gave no response at all. All the muscles of the right arm, forearm and hand were unaffected. X-ray showed no abnormality of bones in the spine, bones of shoulder girdle, or in the shoulder joint. By way of treatment the affected arm was supported and rested and later massage was instituted, but there was no marked improvement. He was discharged from hospital as an invalid on April 15, 1930.

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A few weeks later (May 26) Lance-Corporal B. was admitted to hospital and stated that a month or two prior to his admission to hospital for an operation for varicocele, in July, 1928, he had been employed on a fatigue similar to that of the Guardsman and had been lifting heavy weights, but he had noticed no definite pain until he had "come round" from the anæsthetic.

He said the pain in his right shoulder was then very bad at times and lasted for eight weeks, and during this period he noticed weakness in the right arm and inability to raise it above the horizontal; in spite of treatment by massage and support there had been no improvement up to the present time. On examination, the clinical condition was found exactly similar to that of the first case, that is, a paralysis of the serratus magnus alone. The electrical reactions, too, were the same as in the first case.

The serratus magnus is supplied by the long thoracic nerve or the "nerve of Bell" as it is sometimes called, which is derived from the roots of the fifth, sixth and seventh cervical nerves. This nerve, in its course, can be injured by excessive strain such as lifting or wheeling heavy weights, hanging by the arms, wielding heavy hammers or by keeping the arms unduly outstretched. It can also be affected by the toxin of typhoid fever, diphtheria, influenza or other toxic processes, and it is often associated with inflammation of the subscapular bursa, close to which the nerve runs. "Winged scapula" can be also the result of lesions of the subtrapezial plexus, which is formed by the third and fourth cervical nerves, in which case the corresponding muscles are affected and the serratus remains unharmed. In this event also there is usually an area of anæsthesia of the skin over the upper part of the deltoid muscle (C. 4).

Finally, serratus magnus palsy may be associated with paralysis of other muscles as may be seen in primary myopathies, acute poliomyelitis, progressive muscular atrophy and lesions of the brachial plexus.

III.—Acute Rapid Ascending Paralysis.

Guardsman H., aged 21. On March 4, 1930, he was walking along the street, when suddenly without any pain or warning his legs gave way and he fell down. He was just able to get up and, with the aid of some railings, he succeeded in reaching a house. Here he sat down and was subsequently sent to his barracks. It was now painful to walk, the right leg being especially painful; there was pain also in his back and chest and he was incontinent of urine. Previous to this he had never had anything similar to this attack. His father stated that two of his children had died, one from a similar attack to this man's, and one from "meningitis." No personal history of venereal disease.

On admission to hospital, on March 6, 1930, he was a mentally bright, healthy looking youth who was able to recall all that had happened. His temperature was 99° F. There was loss of power in both legs, and tendon

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reflexes in both legs were very active. Abdominal reflexes absent. There was complete bilateral anæsthesia below the nipples, and patchy anæsthesia to pin-prick over both arms below the deltoids. Pupillary reactions and eye movements were normal. He was unable to pass water and it was necessary, therefore, to empty his bladder with a catheter.

On the 7th, he was mentally clear but somewhat drowsy. He had a frequent cough, the expiratory element of which was particularly weak and ineffective and respiration was mainly diaphragmatic. He lay with eyes closed and seemed to resent interference; speech appeared normal and memory still good. Both pupils now contracted with sluggish reaction to light; eye movements full; no nystagmus, moderate bilateral ptosis. Slight right-sided facial weakness. Optic discs were slightly hyperæmic, but there was no papilloedema; vessels congested. Complete flaccid paralysis of both legs; knee-jerks and ankle-jerks absent; both plantar reflexes "flexor." Abdominal reflexes absent. The diaphragm was working but the intercostals were paralysed and the accessory respiratory muscles of the neck were now brought into play. In both arms the muscle power was feeble and the grip poor, but voluntary movement remained good. There was complete sensory loss, both deep and superficial, in both legs and over the trunk below level of the second dorsal. Patchy anæsthesia was noted down both arms, especially on their inner sides.

Examination of the chest showed a poor air-entry all over the lungs and a few moist râles at both bases. Complexion was now cyanotic; heart's action was rapid but appeared healthy. Temperature 102° F. There was again retention of urine and twenty ounces were withdrawn by catheter. Lumbar puncture proved a dry tap.

On the 8th, the general condition had improved somewhat. His colour was better and respiration less distressed, but he was still cyanosed. Lumbar puncture proved again a dry tap. He was still able to swallow his food well. The alæ nasi were working, also accessory respiratory muscles, and diaphragm movement was still present. Temperature was 103° F., pulse 100, respirations 46. Urine: acid, specific gravity 1030, no albumin, no sugar.

On the 9th his condition was much the same. Temperature 102·3° F., respirations 32, pulse 100. No signs of pneumonia, but there was some œdema at the bases of the lungs. He was very ill during the night with increasing cyanosis and a very ineffective and feeble cough. Atropine and continuous oxygen failed to give relief, and he died at 6 a.m. on the morning of the 10th.

From the acute onset with pyrexia, mild at first, but which became greater subsequently, the initial increase in the reflexes of the lower limbs, which at first suggested a paraplegia, the disturbance of sensations running *pari passu* with the loss of motor power, and the involvement of the sphincters, a clinical diagnosis of acute diffuse ascending myelitis was made, due most probably to the virus of acute poliomyelitis.

With permission, a partial post-mortem only was performed. The brain

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was rather engorged and weighed 3¼ pounds. There was no evidence of meningitis at the base of the brain and no evidence of tuberculosis, after careful search. Lateral ventricles were absolutely dry. The spinal meninges appeared very inflamed and the spinal cord appeared to be swollen and engorged. Other viscera not examined. Sections of the brain, medulla and spinal cord, including lumbar enlargement and thoracic portion, were saved for microscopic examination, as a result of which the pathologist reported that the changes seen in the cord and meninges were consistent with those of acute poliomyelitis.

On May 26, 1930, i.e., about six weeks later, Serjeant M., aged 30, was admitted to the Queen Alexandra Military Hospital, and gave this history :— On the afternoon of the 24th, while returning home from his office he noticed sudden onset of weakness in his legs. On the morning of the 25th he was able to get out of bed, but found he was quite unable to stand up without support, and he was compelled to fall back into his bed. Later in the day he found all power in his legs had gone. He had served in Egypt, where he had suffered from one or two feverish attacks, but he did not report sick. He said that three weeks ago he contracted a cold in his head associated with a nasal discharge and that this nasal discharge had persisted until three days prior to the onset of weakness. On admission he looked ill, exhausted and was of a pale, toxic appearance. Temperature 96° F., pulse 96.

There was almost complete loss of power in the lower limbs and there was weakness in the back and in the arms. The cranial nerves appeared normal and the pupils reacted to light and accommodation normally. The breathing was carried out feebly by the intercostal muscles, but mainly by the diaphragm. All tendon-jerks were lost in the lower limbs and present only feebly in the arms. There was no response to plantar stimulation. Heart and lungs appeared healthy. Examination of the abdomen presented no abnormality. Sensations were unaffected. Sphincters were controlled, but he said he had had some difficulty in micturition before admission to hospital.

On the 27th, temperature rose to 99·6° F. and he had lost the power in his arms, the intercostal muscles were now paralysed and respiration was being carried out by the diaphragm assisted by the accessory muscles in the neck. Calf muscles were tender. Sphincters were still controlled. Joint sense was impaired.

The blood Wassermann reaction was negative and the cerebro-spinal fluid, which was not under pressure, was quite clear, showed the presence of lymphocytes (7 per cubic millimetre) and sugar, but no increase of globulin, gave no growth of organisms on culture, and a negative Wassermann reaction. No organisms were seen in the stained film. On the 28th the diaphragm became involved gradually in the paralytic process, the respirations became more laboured, resulting in increased cyanosis until he succumbed just after mid-day, within four days from the onset.

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In this case the clinical diagnosis lay between acute ascending poliomyelitis, acute polyneuritis and Landry's acute ascending paralysis. If, however, Landry's paralysis is considered, as it is by some, to be a polyneuritis, then the diagnosis lay between the acute poliomyelitis and acute polyneuritis, and clinically it becomes very difficult to differentiate absolutely between these two during life, for the clinical picture described above would represent one or the other equally well. At the post-mortem the lungs, heart, liver and kidneys showed no naked-eye evidences of disease. The spleen weighed $8\frac{3}{4}$ ounces and showed a small organized infarct at its lower pole. The brain and spinal cord showed no macroscopic changes and microscopic examination of these tissues showed no obvious abnormality.

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FRONTIER REMINISCENCES.

By Lieutenant-Colonel T. S. DUDDING, O.B.E.,
Royal Army Medical Corps.

(*Continued from p.* 270.)

The organization of the transport into an orderly body was at first a somewhat complicated process, as it consisted of innumerable camels and mules with drivers unused to military ways, and of whom a very large number did not appear to understand the lingua franca. At first on the departure of the main body from the camp on its advance it was followed by a seething crowd of animals and their drivers blocking up the one roadway leading down from the camp into the river bed, resulting in great delay and confusion, and intermingling of animals of different units. This was speedily remedied by the construction of more tracks to and from the river-bed and the preliminary parking of the animals in it ready to follow on immediately after the troops. With such large numbers of animals the length of the column was too great for single file. Straggling delayed the advance of the troops, as it was very necessary to move as a whole, otherwise ample opportunities would be given to the enemy to hamper us in the rear. It is very surprising that in the early stages at any rate so little advantage was taken by him of this obvious opportunity. To speed up the progress of the transport a double line of animals two abreast was maintained along the river bed, and on reaching a camping ground on the top of the cliffs parties were detailed to make tracks up these to enable the animals to bring the baggage into camp. This frequently led to delay in getting settled in, when the advance had been held up by a stubborn resistance, and on more than one occasion the whole force had to return to its original camp through failure to make sufficient headway during the daylight hours to enable a suitable camp to be gained before dark. At other times it was not feasible for the animals to remain in the upper camp, and they had to remain parked in the river bed, where special picqueting arrangements had to be made. It was on these occasions that, despite all precautions, the enemy would relieve us periodically of two or three camels. It was always a mystery how he could do it without anyone detecting him.

The camping ground at Kotkai consisted of a large terraced plateau overhanging the river with ample room for all, though the access was at first not too good. But the tracks were increased and improved, and additional ones made for watering purposes and for the move forwards. The force remained here for nine days, collecting stores, strengthening the camp, picquet making and preparing for the further advance. Brisk attacks were

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made by the enemy on the supporting troops and we incurred some 150 casualties. In one of these Lieutenant Kenny of the 4/39 Garhwal Rifles and a small party of his men covered themselves with glory by remaining to cover the withdrawal of wounded over very difficult ground, but gave up their lives in doing so. For this he was awarded a posthumous V.C.

About four miles ahead of Kotkai was the famous Ahnai Tangi where the river bed narrowed to some eighty feet in width, the hills overhanging it and ahead forming a very strong line of defence against an oncoming foe. On January 7 the force advanced with a view to seizing the tangi, but being held up in its attempt to establish picquets on commanding ground had to return to Kotkai. These operations had to be repeated on the 9th and again on the 10th. Some advance was made by the establishment of a one brigade camp in the river bed at Ghurlama Kach. It was at this point that the G.O.C. decided to depart from the usual frontier method of doing all the fighting by day and "digging in" at night until the following day. On January 11, by the adoption of a night march he surprised the enemy and seized the ground on both sides of the river at Ahnai below the Tangi; this enabled him to bring the main body and the whole of his transport from Kotkai, and with a nearer starting point to have a better chance of advance the same day after forcing the Tangi.

The 12th and 13th were occupied in making roads from the Ahnai Camp to the river bed, the access having been prolonged and difficult, and in the dark hours of the early morning of the 14th the advance through the Tangi and upon the formidable positions beyond was commenced. The force actually engaged on these operations in which the enemy disputed the passage most stubbornly was as follows:—

(1) Advanced guard, consisting of infantry 1½ battalions, artillery Indian mountain battery (one section), signals, sappers and miners, an A.D.S. party consisting approximately of one section of a field ambulance less its camel transport but with additional bearers, and the usual water party. This force advanced along the river bed in the dark through the tangi, the heights on either side of which had been previously occupied and picqueted.

(2) Special flank guard consisting of infantry 2 companies with its regimental medical party and two stretcher squads from the field ambulance; this was instructed to proceed along the top of a high ridge and make good the heights which towered above the river on the right of the advance to a nearly sheer height of 900 feet. This ridge of the Konr range terminated in a point known as Flathead Left, which was commanded by another point to the east known as Flathead Right, and to the north by the Marble Arch Cliffs; the latter also commanded any advance up the river bed.

(3) Main body, consisting of cavalry 1 troop, artillery 2 mountain batteries (less 3 sections), infantry 1½ battalions, pioneers 1 battalion, and sappers and miners 1 company (less parties with advanced guard), field

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ambulances 1½, plus transport consisting of between 4,000 and 5,000 animals.

(4) Rearguard, consisting of infantry 2 battalions, artillery 2 sections.

Very material assistance was given by the Air Force, whose low flying machine gunning was invaluable.

The resistance from the enemy on Flathead Left and Marble Arch was very strong. The situation on the former became very critical, due to ammunition running out and numerous casualties, but was saved by the fine hand-to-hand fighting of the Gurkhas in which stones had to be employed in lieu of other missiles, and by the timely arrival of reinforcements. The fire from Marble Arch held up the advance along the river bed, but the enemy suffered many casualties from our guns, rifles and aeroplanes. Two of the latter were shot down, one being compelled to descend in the river bed ahead of the advance, but the rushing forward of a covering party enabled its occupants to run back into our lines.

All the transport was now massed in the river bed close behind the main body, and as the day was getting far advanced, the G.O.C. decided to try and hold the heights we had already taken at considerable loss to ourselves and to risk the occupation of a thoroughly bad position in the river bed on some cultivated ground at Asa Khan. Commanded as it was by heights strongly held by the enemy, with our own small parties hanging on by the skin of their teeth through the night to the positions they had so hardly won, and with animals and men packed *en masse* on an exceedingly small area, which was continuously under long-distance fire from the enemy and likely to be untenable if any one of our positions was retaken, the situation was not an enviable one. Our casualties were heavy, amounting to 390, of whom 15 were British officers, 9 being killed and 6 wounded. Only one medical unit could open, and that in a very cramped form owing to the small area of ground available. It had been possible to send back only a few of the earliest casualties to Kotkai, so practically the whole of the wounded had to be kept until the following day, when some 200 of the worst cases were evacuated. Owing to the great demand on the medical transport, the remainder of the sick had to remain another day when a further 200 were sent down the line. The medical units at Kotkai were hard pushed to cope with such numbers and the transport available was insufficient for their complete disposal. These units, as far as can be remembered, consisted of a (50 patients) combined staging section and two sections of a field ambulance (50 patients). With considerable assistance from the administrative staff of the camp the situation was dealt with, transport being sent up from Jandola, and extra tentage, blankets, etc., furnished.

The enemies' casualties had been heavy—at least 400 as ascertained later—and he was evidently considerably disheartened at his inability to drive us back from a position in which the ground was all in his favour. Considering the massing of the animals, it is surprising that there were so

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few casualties amongst them, as the area they occupied was subject throughout to long range fire. The disregard of the camels to this was amusing at times, as here one could be seen scratching with its hind legs at the point of entrance of a spent bullet as if it were dealing with a biting fly, whilst another with a contemptuous shake of the head dislodged a missile which was inconveniencing his nostrils or his cheek temporarily.

The extreme steepness of the heights made the task of the ammunition mules a very difficult one, the foothold for four-footed beasts being very precarious. One mule of a pair after climbing up 900 feet lost its foothold, and chained to his fellow, dragged him down the slope with himself. The two of them were observed rolling down the sheer face of the cliff fastened together inextricably by their leading chains and tying themselves into extraordinary knots. Their loads breaking away from them increased the rapidity of their descent, which was accompanied by a small avalanche of stones and boulders, but the bond which had held them together throughout their daily toil was not severed. And so they speedily passed united to what seemed their inevitable end. But to our astonishment when they came to a final stop just above the river bed, after a rest of a second or two to recover their wind and to make sure that there was no further roll to come, one just got up followed by the other, they both shook themselves and then calmly smelled around still "en paire," to see what grazing they could find.

For the next three days the force remained at Asa Khan evacuating its casualties, getting up further supplies, strengthening the position, and establishing further picquets in advance of camp. As was customary after receiving heavy losses the enemy lashkars, disheartened, began to disperse to their villages with their wounded and dead, thus loosening their hold on the strong positions occupied by them. This enabled us to seize Marble Arch and other strong points with little opposition and loss, and so make good the route for our further advance to Sorarogha, which was accomplished on January 18 at a comparatively small loss. Our additional casualties after the passage of the Tangi amounted to fifty only.

The advantages of using the dark hours before the daylight for advancing up to enemy positions were now appreciated to the full, much to our gain and the enemy's loss and discomfiture. He was not accustomed to having his nights disturbed, many of his men withdrawing in the evening to their villages and caves. He looked on this method of fighting as taking a mean advantage. He was further deprived to a very large extent of the value of his rifle, he could not see his foes until they were close to him, nor was the cover, at the taking of which amongst the rocks and boulders in his natural coloured garb he was an adept, of any use to him. But to carry a night advance out successfully needed troops well disciplined, steady, with their wits about them and well able to endure exposure and fatigue.

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The camp at Sorarogha was situated on open ground overhanging and 300 feet above the river bed. Before it could be reached by the transport, tracks for the ascent had to be made by the pioneers; after the taking of certain advanced positions and the establishment of permanent picquets in them, it formed a very suitable roomy area for a permanent camp despite the disadvantage of having to lift our water up from the river bed, and it filled a badly wanted need in giving us a landing ground for our aeroplanes. The stay of nine days here was as usual occupied in making preparations for the further advance, collecting supplies and giving the troops a rest, which was needed, as we had fought no less than twenty actions in the last thirty days. Moreover, the weather had begun to deteriorate, and rain and snow commenced to fall, which began to have their effects on the less hardy among the troops; and a certain amount of influenza increased our numbers for evacuation.

Ahead of us lay some formidable country along our river route, commencing with another tangi—Barari—to be forced. This was flanked on either side by commanding positions, Barari Left and Right, and ahead, after a bend in the river bed, three strong heights, Barari Centre, the Barrier and Gibraltar, were very definite blocks to further advance until the enemy could be driven from them. The preparations for securing and establishing picquets on the two Tangi positions and another known as the Bluff cost us some sixty casualties. The occupation of these enabled us to pass through the Tangi on January 28 in the hope of reaching a camp at Bangiwala. But this was not to be, as the nature of the terrain gave the enemy several exceedingly powerful positions whose full strength could not be foreseen until we actually reached them. Under cover of darkness the advanced troops, after some slight opposition in the Tangi, took possession of Barari Centre, and by dawn were in a position to launch an attack on the formidable Barrier. This hill had a difficult steep ascent from our side, a narrow ridge a few feet wide on the top, and an easy slope falling away on the far side, so that it provided an excellent position for the enemy. Fortunately, the night march had taken them by surprise, and we gained possession of it with practically no opposition.

But Gibraltar delayed the further advance owing to accurate sniping from a party of the enemy situated in wooded nullas and ravines from which it was difficult to dislodge them. However, this was done eventually, and Gibraltar was occupied and picqueted, but as it was now late in the day it was decided to form camp for the night at Ahmedwan on the arable Kachs in the river bed with a view to advancing the next day. A very disturbed night ensued chiefly owing to some of the young troops who were occupying the ridges of the hills immediately overhanging the camp imagining an attack from the enemy in every noise they thought they heard. It was known that the lashkars from far around were concentrating in strength just ahead of Bangiwala, and so it was very necessary to be vigilant. The weather, too, had changed for the worse, rain and snow falling, and the

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camp became a quagmire and impassable for the transport, so further operations had to be postponed for four days. Our casualties which had amounted to sixty-nine were evacuated, and we occupied ourselves in reconnaissance and making stone pathways for ourselves and the transport to enable us to get out of the soft river silt on which we were encamped. Enemy sniping from the woodlands could not be kept down completely, and they made themselves very objectionable in this respect at night just at the time of our evening meal, of which they appeared to be fully aware. The material damage caused was small, a few animals being wounded, and one of the veterinary officers reported the disintegration of his bottle of hairwash by a bullet when he was sitting in his tent.

The enemy had been strongly reinforced, and the Afghan leader, Shah Daula, had joined them with two guns from which great things were hoped. In view of the strong opposition expected, a night advance was resolved upon and carried out with great success, with the result that we were able to make two miles of ground before the enemy expected the move and so to force him to evacuate positions held by him. All the objectives were gained with the small loss of thirty-four, and camp was established at Aka Khel soon after daybreak. Shah Daula's guns had taken up a position in front of a cave at Shin Konr, but after a few ineffective rounds, most of which did not burst, they were speedily silenced by a section of our 2·75 howitzers from the Aka Khel Plateau. Discouraged by the failure of these guns and the loss of their positions, the lashkars began to scatter again, and pushing on our successes by further night marches, Janjal was occupied on the 5th, and Piazza Raghza on February 6, with the loss of only nine more casualties due to the enemy.

But these were our least hardships. The weather was atrocious, with rain, snow and biting winds. The night march from Aka Khel was undertaken in a snowstorm with the thermometer registering 25° of frost. The tortuous stream was frozen at its edges, and the continuous crossing and re-crossing of this in the biting wind resulted in the men's legs being covered with a casing of ice. To proceed to occupy positions, to wrench up stones from the frozen ground for picquet construction, and to remain on them in this condition made a great demand on the physical and mental powers of the troops—and therefore it was not surprising that we had a number of cases of frost-bite. But we had been prepared for this, and had previously issued instructions as to anti-frostbite precautions; it was in great part due to the carrying out of these that the numbers incapacitated were not greater. The medical units disposed of 120 cases, but there were many more minor ones in the units who were able to carry on with the timely aid of massage, footpowder, and dry socks.

Piazza Raghza became one of our staging posts on the line of communications. It was a good camp on a plateau above the river and the force remained here for ten days, collecting supplies which, owing to the snow and rain was completed with difficulty, woodcutting combined with

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village destruction, road making and preparing for the future advance. The slopes of many of the hills were now covered with a stunted oak which provided a certain amount of fuel, but also gave cover to the enemy. A further twenty-eight casualties occurred here as a result of enemy action, night sniping being a regular feature.

The enemy had been trying to reopen negotiations in a fitful manner. They had failed to carry out the agreement arrived at in Jandola in December, and were now told that as they had not complied with its conditions, it was null and void, and that the advance would continue to Makin and Kanigurram. These would be destroyed if an increased number of rifles was not given up. So on February 15 the force set out for Marobi via the Dwa Tangi. This place is at the junction of two streams, the Baddar Toi from Kanigurram, and the Dara Toi from Makin. Picquets were established in the dark, Dara Toi East and Oxford Circus, and the main columns passed through the tangi without much opposition, and up the Dara Toi to Marobi where camp was pitched on Kach areas in the river bed. On the following day despite continuous harassing by the enemy Tauda China was reached, the fighting of the two days costing us thirty-seven casualties. The intense cold still continued.

Tauda China camp was situated on the southern end of a fine rolling raghza or plain which ran northwards to the area which has now become the present Razmak. On its west side was the Tauda China stream coming down from the north into the Dara Toi. To the west lay the scattered populated district known as Makin and immediately beyond this, running from north to south, lay the snow covered mountains with Pir Ghal rising to a height of 11,500 feet. The establishment of permanent picquets for the protection of the camp and for the purpose of carrying out punitive operations was proceeded with, important ones to the north-west and south-west being Tree Hill and Split Hill respectively. The former was close up to Makin and was separated from camp by some difficult ground ; its establishment during the night was prolonged through the party missing their objective. It received constant attention from the enemy during our stay here.

The country consisted of high rocky wooded hills with cultivated terraces on the lower slopes and various villages occupying the open spaces at their feet. Towers of defence existed in large numbers. It was, therefore, a most difficult country to fight in, and offered ideal cover to the tribesmen, who knew every inch of it. On the 17th a wood-cutting party was attacked ; the enemy were driven off, but taking shelter in a demolished village continued to harass us until driven from it into the wood-covered vicinity. It was found impossible to remove our wounded from the village until dark ; this was eventually done, but at a cost of forty-seven casualties. It may be said here that to leave a wounded man out was to condemn him to certain death at the hands of the enemy, and his body to mutilation. The tribesmen have no use for wounded, and the method they adopt for putting a dead foe to their credit is not a nice one.

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From the 17th to 19th village and town destruction as punitive measures was entered upon; but it proved to be a most difficult proceeding, owing to the attentions of the enemy and to the difficulty in keeping them at a distance during house demolition, through the nature of the country. These and ensuing operations cost us 237 casualties, the removal of the wounded over the terraced cultivated areas being a most difficult matter. The too early firing of houses before arrangements have been made for the withdrawal gives rise to smoke which veils the following up tactics so usual to the enemy and also interferes with the covering artillery fire. This accounted for a greater casualty list in the earlier operations of destruction than in the later ones when we had learned by experience. In these operations round Makin some fifty-one towers and 450 important houses were destroyed. Destruction of the more distant towers offered good practice for the artillery, but it was expensive in ammunition, as their solid construction demanded several hits before they came toppling down. One imposing tower known to us as "Eddystone" was destroyed by the fire of our small mountain howitzers at a range of 4,700 yards at a cost of ten rounds which was considered cheap. Though so solidly constructed that they might have been expected to stand the weight of a cathedral spire, yet one of them at Kotkai occupied by a picquet collapsed and cost us fifteen killed and seven injured. But this was due to an excess of sandbags on a roof already weakened by rain.

Whilst at Tauda China, the enemy intimated that they would hand in the number of rifles demanded so as to stop our advance against Kanigurram. But owing to difficulties in collection only a portion were brought in, many of them being without bolts and magazines. The arrangements for the jirga for the handing in of the rifles were somewhat marred by the untimely arrival of one of our aeroplanes, whose "crew" seeing a fine target in a collection of the enemy advancing on the camp with rifles promptly came down and started machine gunning them, to their very natural annoyance and that of our General Officer Commanding who was doing his best to encourage them to come in. However apparently little damage was done, and the speedy exhibition of the Popham panel for "Get out" sent the over zealous airman back on his fifty miles' flight to his breakfast at Mian Wali. Apparently, as we learned afterwards, he had returned from leave too late the night before to know of the instructions that had been issued for the jirga at Makin on the morrow.

Considerable annoyance and distress to us had been caused by the action of enemy followers in desecrating the graves of our dead, especially the Christian ones, the bodies being dug up and robbed of their clothing and blanket shrouds as well as being mutilated. It became therefore the policy when burial took place to avoid leaving any indication of where a grave was situated by taking all possible steps to obliterate its site. In the case of an officer, the burial on the Tauda China Raghza took place in the dusk and a company of infantry was marched backwards and forwards over the

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grave area until there was no appearance of any freshly dug grave. In addition it was resolved, if possible, to get our own back for some of these previous acts of the enemy, and to this purpose a grave was dug and in it was interred with due ceremony in the daylight a "corpse" consisting of explosive carefully shrouded in a blanket in such a manner as would more than compensate for his labours anyone possessed of an antiquarian's desire for knowledge. The "grave" was carefully filled in and suitably marked for all who came hereafter to see. The insatiable curiosity of the Mahsud was heard by us to be satisfied to the full within half an hour of our withdrawal from the camp. Later information told us that eight casualties had been incurred, seven men being blown to pieces.

As the withdrawal from Makin was not likely to be accomplished in the ordinary way without a considerable number of casualties, special precautions were taken to avoid any information of its taking place from reaching the enemy. No visible preparations were made until after dark, and picquets were not withdrawn till the last moment under cover of darkness. Extreme precaution, ingenuity and vigilance on the part of the picquet commanders was necessary to avoid contact with the enemy, especially in the case of Split Hill and Tree Hill picquets which were usually carefully watched and attended to by snipers between the picquets and the camp, and it was greatly to their credit that we were able to get away from camp without our move having been detected till too late to bring any pressure to bear. Our only casualties were in the withdrawal of a river-side picquet, a small party being caught by the enemy during the process of getting down into the river bed whilst out of range of the covering troops. This cost us two killed and six prisoners, together of course with their rifles and ammunition, which were much more valuable prizes. The prisoners themselves were returned to us later.

On the night of March 1 we encamped at Dwa Toi ready for our advance up the Baddar Toi to Kanigurram. Occupation of two strong points up stream as permanent picquets had been previously carried out by troops at Piazza, so on March 3, under cover of darkness the column set out. Another tangi had to be passed through, the rugged and steep bush covered slopes making possible a most formidable opposition. A strong enemy fire was opened on our troops before dawn, but the steady advance up the river had disheartened him and eventually resulted in our securing the "Dam," a prominent projecting spur which, however, was subject to heavy enemy sniping from wooded cover. This was eventually searched and cleared by shrapnel from the howitzers firing from under cover.

But the heart had gone out of the enemy opposition, and we were able to reach and occupy Ladha Camp—an island in the river bed—though he continued to harass us severely with his sniping from under cover of the wooded slopes. On the next day camp was moved up to the high ground above the river bed to the permanent Ladha strongpoint, and on the 6th the advance to Kanigurram was resumed. A small continuous opposition occurred

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but did not delay us, and a camp site on the opposite side of the river and 800 yards east of the town was reached. There was a certain amount of sniping ahead and to the flanks during the occupation of the ground, and we incurred casualties in establishing picquets to the north-west of the town. Several camp picquets were considered very necessary in order to control the sniping proclivities of the enemy. Our casualties due to him since our departure from Makin only amounted to forty-eight.

The town of Kanigurram was much more deserving of its name than was Makin, as its houses were collected together. They were situated in terraces on a steeply sloping ridge on the north side of the river, and consisted for the most part of flat-topped houses of sun-baked brick. The town had been reported completely destroyed by the bombing of aeroplanes, but it was still standing pretty intact when we arrived there, save for holes in a few roofs. Bombing is an expensive method to use for the destruction of mud-built houses. The town was almost empty when we went into it, and any contents of value it may have had had been removed, though doubtless some of its inhabitants came back at night. The inhabitants are principally Urmars—not Mahsuds—though it is regarded as the capital of the country, and the Mahsud assemblies are held there, at the expense of the Urmars. It is an important commercial centre with a large bazaar, and several rifle and knife factories.

The weather was cold and wintry, heavy snow falling on the 13th and 14th, which left the camp very wet when the snow melted. On the 18th we experienced a violent thunderstorm, and two sentries were struck. These trying conditions interrupted the convoys and caused a good deal of discomfort. We continued to receive a certain amount of attention from the snipers, and one of our few B.O.R.'s, a howitzer gunner, was unfortunately hit in the abdomen whilst playing cards in his tent, and succumbed. He was the only B.O.R. casualty due to enemy action, the howitzer section being the only actual British fighting unit with the column.

A jirga was held just on the borders of the camp on March 21, as a result of which rifles now began to come in from the enemy, and most of the tribes began to make genuine efforts to pay up. But certain outside sections in the upper reaches of the Baddar Toi were still defiant, and so punitive operations were undertaken against them on April 6 to 8 by a column consisting of six guns, 2,600 rifles and 2,000 animals. Some towers, villages and property were destroyed before the column returned to Kanigurram with a loss of some sixty casualties. Whilst the column was out, the remainder shifted camp to a better site on the north side of the river, slightly further to the east, and made it ready for them on their return.

During the stay at Kanigurram the troops were able to get a much needed rest, and to cleanse themselves, and repair the ravages of the campaign. Supplies of hot water were arranged at a central bathing establishment instituted on the river bank, the water was heated in empty kerosene tins placed on fire trenches converging to a central

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chimney. Lice were fairly prevalent, and attempts had been made to keep them under by individual boiling of clothing whenever possible, hot cresol baths for the under-garments, and vermijelly and N.C.I. powder for body application. An attempt was also made to start an hot-air chamber for disinfecting purposes. This was constructed by the sappers by hollowing out a chamber in a terrace of one of the cultivated patches, and fitting a blanket door. Charcoal braziers were our source of heat, but it took some days before we could get a heat approaching that considered sufficient to warrant a test. However, such a temperature was reached, and a party of Gurkhas were marched down and bathed whilst their garments were being "disinfected." The process was probably a trifle prolonged, in order to make a certainty of it. The Gurkhas went away in their treated garments laughing and joking and full of hope that they were now free from a pest which disturbed their slumbers. But it was an infuriated party that came down to the bathing place the following morning vowing vengeance, as they had had a worse night than ever before and were "more alive than ever." For what had happened was that though the requisite temperature had been indicated on the thermometer in the doorway, it was a *moist* heat and not a dry one, the moisture being supplied from the earthen walls of the chamber cut into the soil at the foot of slopes which were saturated with the moisture coming from the higher ground. Such an atmosphere was an ideal one for hatching out the eggs which their garments contained in great numbers. We lived and learned.

A Civil dispensary was set up in an adjoining building and a considerable number of sick inhabitants were treated there, and the powers of the medical attendants to heal were somewhat overtaxed. One unfortunate patient was an old woman whose hand had been blown off as a result of a booby trap we had set. Our signal communications were continually being cut at night, despite all precautions, and many traps were set to try and catch out the individuals. In this case a box of explosive was the bait which was apparently taken by the old woman out of pure curiosity.

The inhabitants were in somewhat parlous state as regards their food supplies—especially meat—and when we were disposing of our dead camels and mules which had succumbed to enemy bullets or had to be killed, a request was sent in that they might be allowed to have the carcases as food in lieu of merely the savoury smell of roast flesh which was wafted over to them in the process of destruction by burning. As at that time it was not our policy to feed the enemy, this request was very definitely refused unless the rifles were forthcoming.

Much valuable survey work was carried out during the period of waiting, and a graded motor road was constructed on the cliff top to near Ladha Camp.

By the end of April combined opposition had practically ceased, and

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the column withdrew from Kanigurram to Ladha strong point. After laying out and arranging for a permanent camp here, the column broke up on May 7, leaving a brigade of infantry and a battery of artillery to garrison it. And so ended a campaign of a magnitude and severity not before experienced on the frontier and carried out by a force composed almost entirely of Indian troops. Our total casualties due to enemy action were nearly 2,300, of which about 70 were amongst British officers, 29 of them being killed. Our sick casualties were much better than in previous campaigns and amounted to 2,000 Indian and 42 British. The proportion of killed to wounded amongst the British officers was 1 to 1·3 and amongst Indian ranks 1 to 3.

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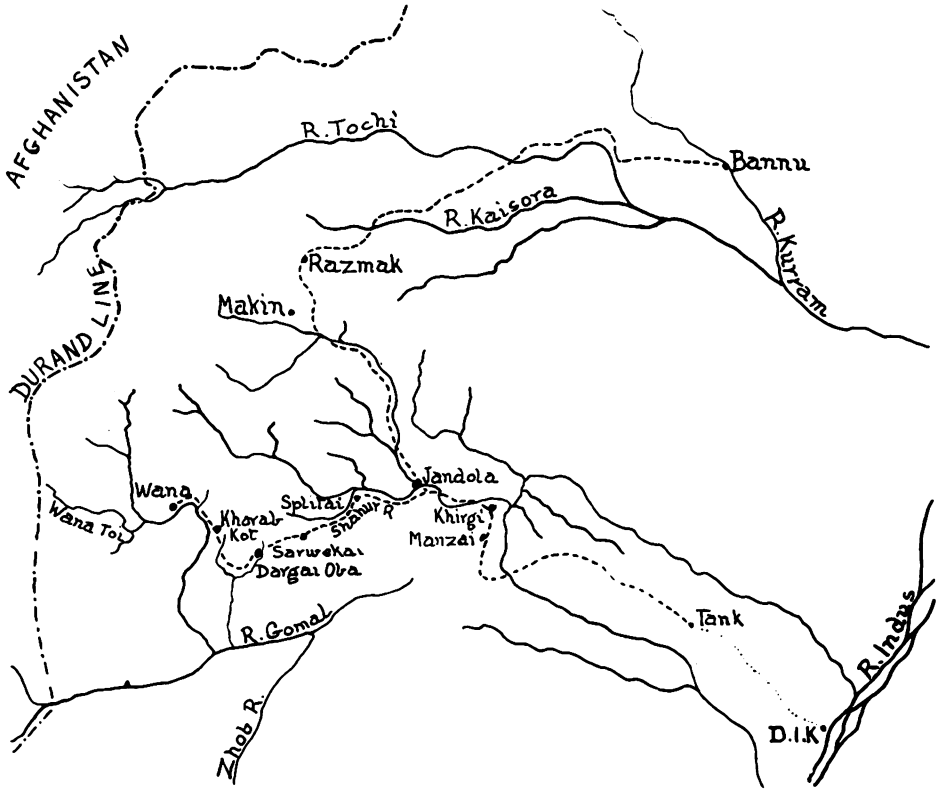
THE RE-OCCUPATION OF WANA.

By "TOTEM."

Foreword.

Since 1860 there has been trouble over Wana; a bone of contention between the British Government and the Afghan Ruler, with the local inhabitants assisting matters by promises, treachery, raids and false agreements.

Wana itself is situated on a large plain, some 4,500 feet high, surrounded by hills rising to 11,000 feet in places and about fifteen miles from the present Afghan boundary.



In 1893 an agreement on the boundary question with the Afghan King and the demarcation of the Durand Line (boundary line) was made, and Wana was occupied next year by a considerable force escorting the Boundary Commission. On November 3 a fierce attack broke into the camp, but was driven off by daylight. Wana reappeared in the limelight

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at intervals up to 1914; for instance in 1904 the Political Agent there was murdered. It was only held by militia until 1917 when a punitive force occupied a camp there for a short while in relief of the militia under whose control the area was being maintained.

In May, 1919, Wana Fort simultaneously with all other posts was evacuated. The Garrison under Major G. H. Russell (now Colonel commanding the 4/12 Frontier Force Rifles in Razmak) was heavily attacked and only eventually got away with difficulty. The exploit is described as one of the finest recorded on the Indian Frontier.

Since that date Wana has been unoccupied by any regular military force and has remained a constant source of intrigue and intelligence for the Border tribes and Afghans, and one of the open routes of possible invasion.

In continuance of the present policy of a series of large garrisons with strong striking forces moving over good roads, the re-occupation of Wana had been decided on for March, 1930. But with the rush of events in Afghanistan and the proclamation of the present King the aspect of affairs was altered and the immediate re-occupation by a brigade from Manzai was ordered for the beginning of November, 1929.

The political folk, however, had been squaring up matters with all the local inhabitants, and the march and re-occupation was carried out without a shot being fired.

The sketch map on page 346 shows our route.

Preparation.

"Ttrrring" said the telephone.

"Speak to D.I.K., sir," said the husky voice of the exchange operator.

"Hullo! is that you, Totem?" said the voice of Loquans, the D.A.D., "the A.D. wants to speak to you."

"Good morning, Totem," said the voice of the A.D., "I want you to take over Command of No. 00 Field Ambulance temporarily. Will you take forty-eight hours' notice now to move? You will get your orders shortly."

"All right, sir, I am ready to move at six hours' notice, any time."

Back to his room hurries Totem to give orders for packing:—

(*a*) Kit to take on a trek of indefinite duration and definite destination, such as buckets, basin, squash racquet, revolver, golf clubs and paint box.

(*b*) All other "penates" including sketches, motor accessories, carpenter's tools and a dozen other things to be left behind.

Then followed three days filled with rumours of every kind, and yet two days more of post office holiday, with more rumours, which held up the arrival of orders.

Totem seizes on the orders and finds he should leave at once for Manzai; in vain he applies to the S.S.O. for transport, every car is booked, and

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reluctantly he decides to unleash his good old "Henry" for the trip in spite of carboned cylinders, knocking big ends and wobbling wheels.

A hurried repair of the most obvious defects leaves "Henry" ready for the journey next day.

Next day "Henry" repays the attention by shedding a brake drum and flattening two tyres, but lands Totem safely at Manzai and his new ambulance.

Here there is constant bustle and scurry, comings and goings, secret orders, ration indents, disposal of kits, arrivals of all kinds and conditions of men, vehicles and equipment.

Totem has his hands full of matters of military and of State importance such as the following:—

(1) Quartermaster: "Shall the men take their spare pants, sir, or pack them in their kits?"

(2) O.C., C.I.M.H. (on telephone): "When you go, will you give me the fire buckets you have in your lines?"

(3) Medical Officer: "Must I take only sixty pounds of kit or can I take my bed, table, chair, library and eiderdown?"

(4) Letter from the Local Audit Officer in pencil:—

"Reference your No. XY 123 dated the 1st April, 1908, and this office reply thereto, ABO98 dated the 1st August, 1921. It is observed that you state that you have paid No. 33333 A/O HAR JIT the sum of annas two and pies six. Please issue a certificate that you have actually paid this amount to this man. It is noted that you have failed to dot the i and cross the t!!!"

(5) Medical Officer (on last morning before march):—

"I have to report, sir, that I have found three cases of mumps in the S—— P—— and there are fifty contacts."

(6) Assistant Surgeon (19.45 hours on evening before the march commences): "The barber reports, sir, that he will not come to Wana with the unit unless he gets eight annas instead of six annas per man."

However the medically trained brain of Totem manages to grapple with each of these vast medical problems in turn and the Unit is ready to march at 07.00 hours on the fateful 1st of November, 1929.

The Opening Phase.

"Panch baje hai, Sahib." (5 o'clock, sir.) The raucous voice of the bearer and the rattle of the chota hazri tray break in on Totem's sweet early morning thoughts.

A hurried shave, look at the cold bath, a breakfast of burnt egg and uncooked bacon and Totem garbs himself once more in the dress of the march.

At the Unit, final touches are being put to the preparations and all is soon ready for the start.

The water pakhals, smelling aloud of chlorine, are emptied and refilled.

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The sweepers' brooms give their final sweep and are safely stowed away in the sweepers' cart. The box of office records and files is packed in a less safe place, in the hope that it may be lost. The cart containing the P.C. oil, used for driving away mosquitoes at night, drives away men and mules by its strong citronella smell. The unit hockey sticks are carefully packed, and finally the C.O.'s baggage is really stowed away and all is ready.

The advance guard detachment, with stretchers, sweepers, water-testing box and marking flags flying, marches off to join the advance guard.

"Fall in the main party." The ambulance "falls in" and with Totem marching at its head, moves off to the place of assembly and the starting point. A short halt is called to allow a gunner's mule to kick all its baggage and trappings on to the road.

The eagle eye of Totem suddenly spots the ambulance rear guard party under a Sub-Assistant Surgeon marching with his main body. "What the —— do you think you are doing here? Why don't you join the rear guard?" "Sir," he replies, "I do not know what rear guard is, nor how to find same. ! ! !" Totem recovers presently, and leads his men on through bucking mules and swearing gunners, through jammed mule carts, past harassed marshalling officers, to the starting point.

The march commences.

The March.

Tramp, tramp, tramp, tramp. The Column swings along with its battalions in front, its train transport in the middle and its motors in the rear, raising a cloud of dust three to four miles long. "Boots, boots, boots, boots, moving up and down again," below; "Dust, dust, dust, dust, swirling up and up again," above. Up past Khirgi, that well-hated spot which nine years ago was a huge hot camp, and into the gorges of the Tak-ki-Zam, over the Kiriwan bridge to that narrow cleft cut by the river through a huge ridge and called the Hinistangi. Picketing was carried out, but this area, once so dangerous, is now guarded by a permanent Scouts post at Jandola.

Totem as S.M.O., rode forward to reach the advance guard at the first camp at Jandola. A harassed Staff Captain walks about, with long strides and marking flags, on a stony football ground; and the new camp site is ready for the units of the Column.

Totem goes off to see that the water supply and its chlorination tests are satisfactory. He finds the Sappers actively erecting their pumps and canvas tanks, and his own S.A.S. busy doing chlorine tests by a small channel immediately below the camp site. He decides that a sentry is needed where the channel crosses under the road, and, pursuing the Staff Captain, states his demand.

"But the water supply is in the river bed," says the S.C. "I put it there."

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"No, it's in that little channel below the crest of the hill," says T. "I have seen it." Hurriedly the harassed S.C. rushes with T. to the spot indicated and falls red-faced on the senior Sapper officer.

"I say, I say, why have you put the water point here?"

"Well, because this is the most convenient place; here is water, up there is the camp and here are my tanks ready," says Sapper.

"Well," says S.C., "joking apart, we're friends and all that, but it is my job to site all water points."

"No it isn't," says Sapper; "it's my job to run the water."

"Oh no, it's my responsibility," says S.C., "and I put it over there."

"What do you know about water?" says Sapper. "How do you know if it is suitable?"

Totem being senior to both, treads firmly on this sparkling conversation, and drags the S.C. away to show him his other sanitary arrangements.

Four hours later the scene is very different.

With clinking picks and shovels fatigue parties are building the perimeter walls; the sick parade is being seen at the ambulance; the ration lorries are discharging their contents; the men have fed and the officers have lunched; a hundred oil-cookers add their perfume and colour to the scene; pickets are out guarding the area and the Column Team is beating the Scouts on the football ground.

"Stand to." 18 hours. A hush falls over the whole camp as every man falls in at his post and stays quiet and watchful; those on the perimeter examining the rapidly darkening landscape and those on internal duties ready for emergencies, until the order "Stand down" is given by the Commander as he makes his inspection rounds.

At 03.00 hours (3 a.m.) Totem finds that once more his hip bone has made contact with a nice sharp flint, and his attention is directed to the noises of the camp; the snore, snore, snore from one fellow medico; the cough, cough, cough from a patient in the next tent; the shsh, shsh, shsh of a whispered conversation of the assistant surgeon interviewing a sick man; the clink, clink clink of syces hammering picketing pegs home again; the composite hum of snores, snorts, coughs and groans that sleeping soldiers always make.

Totem hears close to his head splashings and other horrible sounds of washing and finds the early birds already at their ablutions. A fierce "chup raho" (keep quiet) readily dissolves the meeting only to disclose further sounds of chattering and a soft roaring noise. He looks out further and finds a full session of cooks and others round the oil-cookers disturbing the stillness with their noises and the air with their flames and smoke. The sudden apparition of an infuriated Totem in blue pyjamas is quite enough to disperse the merry meeting.

It is now 05.30 hours, and the camp begins to stir into life; coughings, hoickings, spittings and chatterings increase all round; the hammering of picketing pegs raises a continuous musical tinkle; oil-cookers begin to clatter,

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roar and smoke and finally, the first whistle of the transport officer produces a curious muffled roar mixed with soft whinnies and neighs as 500 mules realize that food is approaching. At last the day breaks and life is resumed in earnest.

The day's march was from Jandola to Splitoi, and through the famous Shahur Tangi; a rocky defile three miles long, with the road cut out of the hill-sides and the gravelled river-bed winding deep below. A nasty place and requiring careful picketing. The Column did this march in two sections, one advanced guard picketing up to and another through the Tangi, while the Scouts assisted on one flank and the aeroplanes patrolled close overhead. A fascinating sight it was to see the Column swinging down into the entrance to the Tangi with its gaunt barren coloured rocks and later crawling up like a gigantic centipede through the neck of the Tangi.

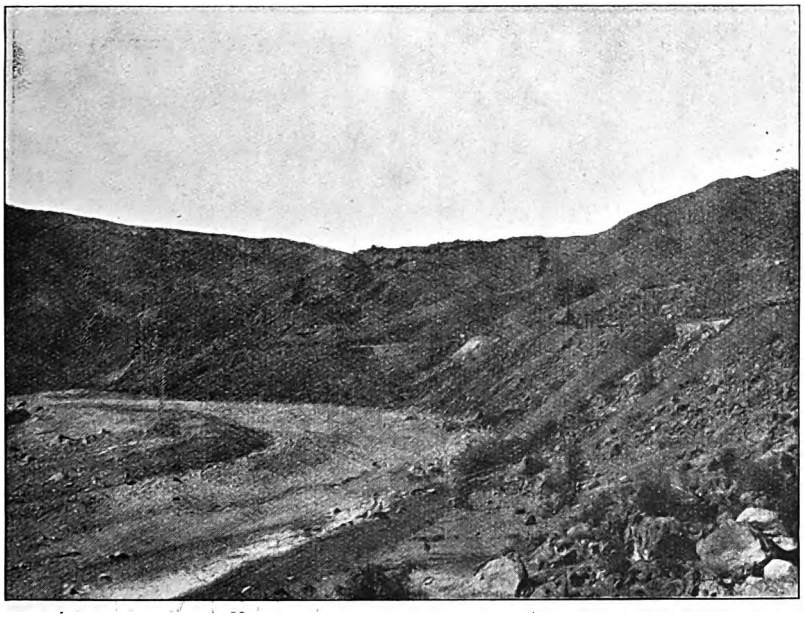


FIG. 1.—The Shahur Tangi. The column crawling up the road.

Camp cleaning at Jandola occupied Totem until the rear guard was ready to move, so mounting his trusty steed he caught up the plodding main body at the entrance to the Tangi and the advance guard at the new camp site. A yet more stony site, on a plateau close by the Scouts' post, overlooking the rugged west entrance to the Shahur Tangi. It is on record that floods rise from the dry river bed to seventy feet deep at this entrance and that during one "show" a thousand camels were swept away.

Camp sights and sounds repeat themselves; patients are seen and evacuated to Manzai by motor ambulance and lorry; the fouling of the

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water supply and a slight difficulty with the local cultivators is cleared up by the A.P.O. (Assistant Political Officer); life settles readily into normal camp routine and "Totem" and his fellow medicos have a hot bath.

Of the march next day to Sarwekai little need be said. A flattish road winding up an open valley of the river, every pool of which swarms with fish. An easy march to a camp site near the landing ground one mile west of Sarwekai Fort, and a camp springing into being with rapid routine.

At Sarwekai, a day of rest, dust, routine work and football against the Scouts. The water supply was from the river bed, the drinking point where water first bubbled from the gravel, animal and washing points below

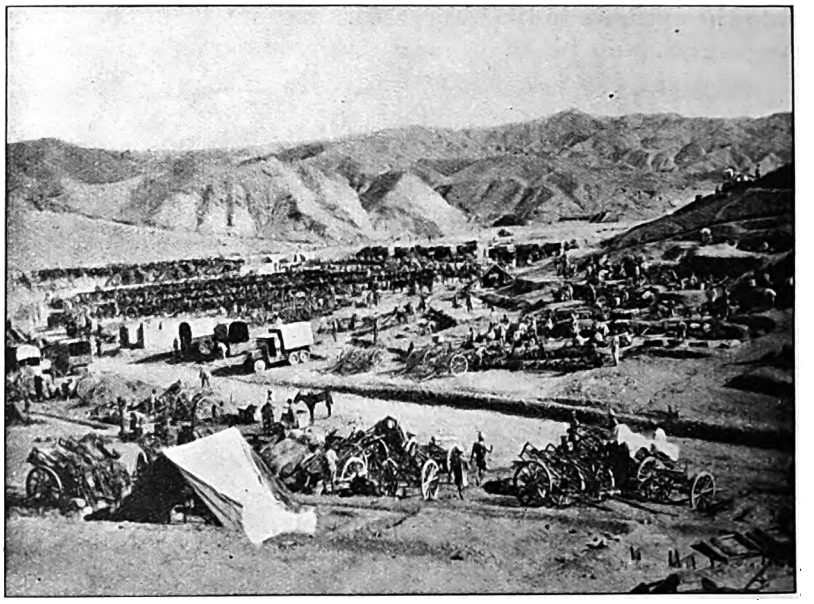


FIG. 2.—Dargai Oba Camp. A general view.

this. After thorough inspection Totem decides to discontinue chlorination. He revisits the point four hours later to see that all is well, and finds:—

(1) Two men of his unit washing at the drinking point;

(2) a series of pools dug in the gravel thirty yards above the drinking point and men washing various portions of their anatomy therein.

After recovering his breath, he decides to continue chlorination. When walking back to camp Totem notices some vultures round a group of bushes 100 yards from camp. Investigation shows that the local meat-merchant has opened his goat-shop there with results indescribable. Totem cannot speak Pushtu, and saving his breath, makes other arrangements.

Towards evening the members of the mess gather round for the odd spot of refreshment. Pointing to the mess table, a table groaning with a

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wonderful assortment of bottles of all shapes and size, the Colonel remarks, "It is a good thing to realize that we really are travelling light and with the minimum of kit."

From Sarwekai the Column, rousing itself at dawn with the muffled roar and whinnies of the hungry mules, marched to Dargai Oba; an interesting march, done at considerable pace, over a series of barren hills, up a long winding incline to a two-mile series of steep curves dropping down to the Dargai Oba valley. A fascinating picture it was from the top of the hill with the curves of the road dropping down, down the barren brown bare hills and a jumbled maze of blue hills filling the distance.

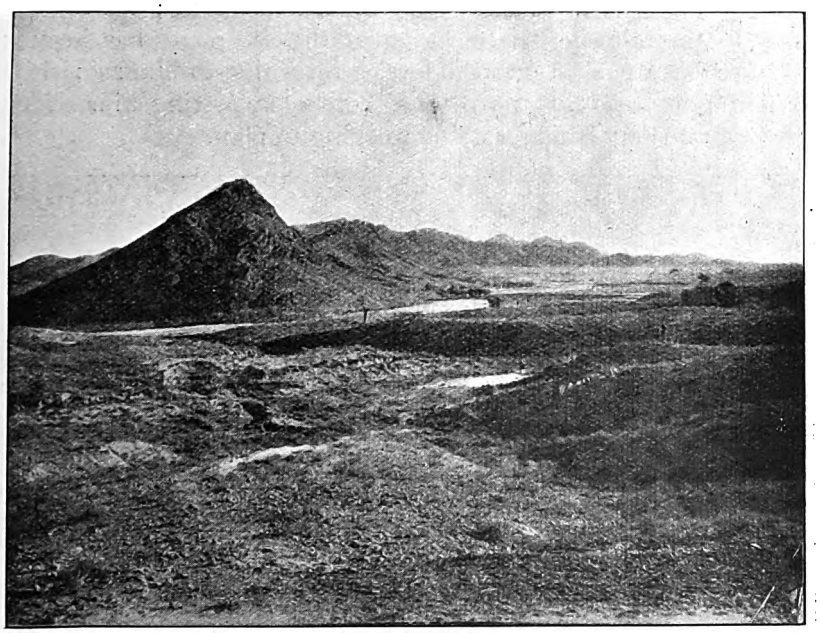


FIG. 3.—Gibraltar Picket. The commanding feature South of the Camp with the Wana Toi flowing round its foot.

Dargai Oba: a picturesque camp site in a horseshoe of hillock with the river bed to the east and barren hills rising steep from this, but a camp site often sniped at night. The water supply was a magnificent spring bubbling from the rock and well protected. Below this a vivid area of green contrasted strongly with the bare brown hills but alas! was covered with clouds of locusts. The ambulance was well placed on a series of terraces with the tent flaps carefully lowered to hide the medicos' comfort from the envious eyes of battalion officers sleeping on the open stony hillside.

The night passed without an incident.

A distinctly uninteresting march next brings the Column to Kharab Kot, a dusty, smoky camp on the ruins of a village, windy and bare. The water

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supply was of interest being from a kharaze. These kharazes are small water channels cut right through the hills, sometimes for miles and perhaps 80 to 100 feet below the ground level. They are made entirely by hand labour, vertical shafts being cut down to the channel level every thirty or forty yards. Water may be carried right across from one valley to another by this means. Very strict tribal laws govern all the water supplies and non-compliance with the laws always leads to trouble and fighting.

The Last Lap.

Thankfully rising from an uncomfortable night the Column prepares to complete the last stage. The advance guard has gone; the mules have been lured to their loads; the cleaning of the camp site has begun; the patients have been packed into the lorries returning to Manzai; the main body is falling in ready to move and Totem is patting himself on the back because all the "bandobast" is working to plan.

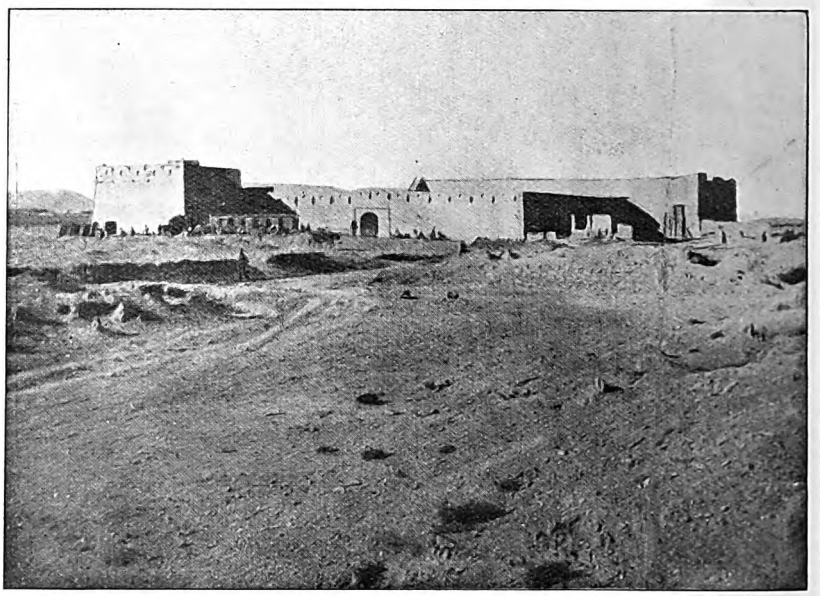


Fig. 4.—The Fort Wana. Note the water-tanks in the front.

"X Battalion's sanitary area has been left uncleaned," reports the assistant surgeon.

"Haven't you made any proper litter disposal area?" asks a gunner officer.

"I have just found another case of mumps," reports a medical officer, with a grin spreading over his face; "and a man with a burnt foot who cannot walk."

Totem ceases patting himself on the back and gets down to business.

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The column gets started and at a fast pace swings along under the frowning sheer rocky mass of the Tora Tiza, into the valley of the Wana Toi. The advance guard is a couple of miles ahead, picketing the route; so Totem, anxious to be the first medical officer to enter Wana, rides on to join the ambulance advance guard detachment.

A halt is called for a while at Tiarza, while the armoured cars move forward and the troops picket the sides of the final gateway on to the Wana plain. When this is done the remainder move rapidly forward, round the bend to the left, over the Wana Toi, and emerge on the eastern edge of a huge plain dotted with numerous villages and an amazingly clear circle of blue hills surrounding it. In the middle distance can be seen the squat form of Wana Fort and bounding the western horizon the blue hills of the Durand line (Afghan border). The plain is cut by many nullahs and is covered with small brown shrub which fills the whole air with a scent of thyme.

Arrived at the camping area the Staff Captain is seen once more busy with marking flags, long strides, picks and a choice selection of words; having marked out the complete camp area according to the pre-arranged plan, his selection of words increases in volume when told by the political officer, "You can't put your camp there because you must not go within 800 yards of that village." The S.C. re-arranges the camp site.

Meanwhile Totem rides forward to the fort to see the well which is to be the entire water supply. The well has recently yielded a wonderful assortment of treasure trove, thrown in when Major Russell evacuated the fort; tins of milk, ammunition boxes, and aeroplane bombs, etc.

The Column arrives and each unit settles down for the night in its appointed area, and the march for the re-occupation is finished.

Next day all are busy settling down: the perimeter is being built; the bazaar springs into being; the transport animals are resting; the sappers are collecting bricks for their mess from the old fort ruins; the medical inspection room is filled with patients and Totem is wrestling with correspondence.

"Will you see Captain Black, sir," says the Orderly Medical Officer. "He has got that axillary abscess; would you like to open it or shall I do it?"

Totem examines it; eagerly he seizes a knife and falling upon the unlucky Black, ruthlessly opens the abscess.

The tale is told, Totem has done the first operation in re-occupied Wana.

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DIPHTHERIA AND ITS SEQUELÆ IN THE NORTH WEST OF INDIA.

By Major S. SMITH,
Royal Army Medical Corps.

There has been a disquieting prevalence of diphtheria, and more especially of post-diphtheritic polyneuritis, during the past year, amongst the European population, throughout the whole of the North West Frontier region of India.

The incidence of diphtheria, and more especially of polyneuritis, has been greatest amongst officers and their families, notably at certain frontier stations, where many cases of severe post-diphtheritic paralysis have occurred.

On the other hand, whilst diphtheria has been relatively common amongst the "Other Ranks," paralysis has been but seldom met with.

I believe this comparative immunity from post-diphtheritic sequelæ in the case of the non-commissioned ranks to be entirely due to the fact that every case of sore throat of any severity is admitted to hospital, three or more swabs are taken on successive days as an *absolute* routine, any cases in the slightest degree clinically suspicious, or which do not react to routine treatment in a very few days, receive an adequate quantity of anti-diphtheritic serum, no matter what the laboratory findings may be.

On the other hand, in the case of officers, and more especially of their families, the examination of the throat is apt to be more perfunctory, there are difficulties in taking an adequate number of throat swabs, many do not report with sore throat, and, in some of the smaller stations, where laboratory facilities are not so good, the media may not be above suspicion.

Whilst some of the cases under review were known to have had diphtheria, K.L.B. having been isolated from their throats and serum injected, others had suffered from sore throat with apparently no clinical resemblance to diphtheria, and throat swabs had proved consistently negative. One case, that of a B.O.R., denied any history of sore throat or even of nasal discharge, yet he developed paralysis typical of the post-diphtheritic variety, and he belonged to a unit in which diphtheria was prevalent at the time.

I can best explain my theme and point out some of the difficulties in diagnosis by a few illustrative cases:—

Case 1.—Pte. D. was admitted to hospital from the Rawalpindi garrison on February 12, 1929, with a history of a "dead feeling" in his feet, of five days' duration, and of inability to keep up with his unit on the march. He had not recently suffered from a sore throat or nasal discharge, but there were several cases of diphtheria from his unit in hospital at the time.

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Clinically, he presented a typical picture of mild post-diphtheritic polyneuritis with characteristic stocking and glove anæsthesia. Numerous throat swabs were negative. He made a complete recovery, leaving hospital two months after admission.

(A similar case occurred in Secunderabad some years ago, and was duly reported at the time [1]: in this case, also, the man gave no antecedent history of sore throat, but admitted to a bad cold two months previously. Diphtheria was prevalent in his unit at the time.)

Case 2.—L/C. S., also of the Rawalpindi garrison, was admitted to hospital on February 25, 1930, and gave a history of bad sore throat a month previously. He examined his own throat at the time with a mirror and noted white patches on both tonsils; he did not report sick with the throat but obtained gargles from the M.I. room orderly. Fourteen days after the onset of sore throat he noticed that fluids tended to regurgitate through his nose, and he suffered from temporary blurring of vision, these two symptoms lasting only a few days; his hands and feet became numb a week later, and he noticed weakness in his legs and unsteadiness in walking about the same time.

He was very white, run down, and shaky on admission, and recovery has been slow in his case; even now, three months later, there is considerable paresis, especially of the dorsiflexors of the wrists and ankles.

The above are the only two cases of post-diphtheritic paralysis that have occurred in the Rawalpindi garrison during the period under review, although many cases of diphtheria occurred and received serum treatment.

No case of sore throat or diphtheria admitted into the British Military Hospital, Rawalpindi, during the same period has so far developed post-diphtheritic sequelæ. A special case book is kept for all admissions for sore throat, wherein are entered full details as to clinical signs, presence or absence of membrane, treatment adopted, clinical course, etc., etc.

Throat swabs are taken on three successive days as an absolute routine, and, as stated above, serum in adequate amount is given immediately on admission in all suspicious cases, irrespective of laboratory findings, and also to all cases, even if not clinically suggestive of diphtheria, which do not clear up in a very few days on symptomatic treatment. This is, I believe, an absolutely necessary routine, and should *never* be omitted.

Case 3.—Lieutenant K., R.A.M.C., was transferred to Murree from a "Plains Station" on May 10, 1929, and gave a history of having suffered from mild sore throat, slight pyrexia, general malaise and fainting attacks, for a fortnight before admission, during which period two or three throat swabs had been taken with negative findings.

On transfer the patient was noted to be very pale and "washed out," his throat was red and congested, with much glairy muco-pus adherent to the posterior pharyngeal wall, and, a most important and suggestive sign, his left lymphatic tonsillar gland was swollen and painful with a small chain of shotty glands leading down from it to the region of the left clavicle.

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From a swab taken from the posterior pharyngeal wall K.L.B. were obtained in pure culture.

Serum was administered, and he made a slow recovery.

Six weeks after admission, on his first being allowed up, he had a typical and alarming attack of paroxysmal tachycardia, with a pulse-rate averaging 200 or more, which lasted for more than two hours. The attack commenced and ceased with absolute suddenness, and was distressing while it lasted, but once the attack was over he felt perfectly well again. He had several similar attacks during convalescence and noted that they were specially liable to occur if he put anything tight round his neck like a collar; it was, in fact, while putting on his collar for the first time after a prolonged period in bed that the first attack commenced. He made a complete recovery and was able to play Rugby football during the following winter.

It is interesting to note that this patient had an electrocardiogram taken of his heart some years before as a medical student and was told that he had marked sinus arrhythmia.

It is just this type of case that one is apt to "miss." His throat was never really acutely sore, nor, I believe, was there any membrane to be seen at any time.

Prolonged sore throat, not amenable to symptomatic treatment, slight irregular pyrexia, malaise and general ill-health, combined with glandular enlargement and a history of fainting attacks, should have given the clue to a correct diagnosis in his case.

One must never forget that membrane is by no means a *sine qua non* in the diagnosis, even, of faucial diphtheria; and it is these insidious cases with, one supposes, just sufficient local resistance to prevent the formation of macroscopic membrane, who are most liable to develop post-diphtheritic sequelæ, for the simple reason that they have not received serum in the early stages.

Case 4.—F/O. S. was transferred from a Frontier Station on January 19, 1930, as a severe case of post-diphtheritic polyneuritis.

He had suffered from a severe attack of clinical follicular tonsillitis during October 1929; a whitish membrane was noted on his left tonsil which persisted for a few days, but, as throat swabs taken at twelve-hour intervals were negative as regards K.L.B., he received no serum.

A persistently high temperature which accompanied and followed his sore throat was held to be due to malaria, and he received a series of intramuscular injections of quinine.

Whilst on convalescent leave a month later, he suffered from weakness of the legs, diplopia, blurring of vision, and regurgitation of fluids.

On transfer to Rawalpindi he was found to be suffering from severe multiple neuritis, obviously post-diphtheritic in origin; there was severe paresis, almost amounting to paralysis, of all four limbs combined with characteristic sensory loss of the stocking and glove variety.

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He made a rapid recovery, and was invalided to the U.K. two months later with almost complete use of both legs.

Case 5.—Major B. was treated in quarters during November and December 1929, suffering from post-diphtheritic paralysis; he gave the following history. He reported with a sore throat early in September and made a rapid clinical recovery on symptomatic treatment with gargles, etc. A few days later he developed a severe follicular tonsillitis and a septic "spot" appeared on his uvula; frequent swabs proved negative to K.L.B. and he returned to duty apparently cured.

Early in November he noticed that he appeared to have lost control of his feet, and they were weak from the knees down; this was followed by weakness in the hands and fingers accompanied by a sensation of "pins and needles." He further stated that early in October he noticed that fluids regurgitated back through his nose, but this he regarded as trivial and did not report sick.

Clinically there was a definite peripheral neuritis of the arms and legs.

The two cases are of interest in that, although frequent swabs were taken and proved negative to K.L.B., both patients must have actually suffered from diphtheria, and in one case membrane was actually present for some days.

It is easy to be "wise after the event," but in my opinion both these cases should have been looked on as suspicious and should have received early serum treatment, irrespective of laboratory findings.

Case 6.—Boy G., aged 12, was admitted to hospital on June 4, 1929, with a history of having been treated as an out-patient from May 23 to 30, for "acute catarrhal tonsillitis," *during which time no swabs were taken.*

On admission he looked ill and "washed out," there was considerable peritonsillar swelling surrounding the left tonsil, and a small piece of membrane could be seen lying at the base of his left tonsil; the left tonsillar gland was swollen, and he had an offensive nasal discharge.

K.L.B. were not seen in the direct smear, being crowded out by a wealth of secondary organisms, but were obtained in pure culture on selective media. The child made a rapid recovery after serum treatment.

This case of course speaks for itself, and negligence was shown in not taking swabs earlier, but it is only one more example of the care we must exercise in swabbing all suspicious throats and nasal discharges, especially in children.

I have cited these cases in no carping spirit, but simply to show how easily mistakes arise, and how valuable time may be lost in the early stages of diphtheria, when serum treatment produces such magical results.

If every case of sore throat, however mild, be regarded as potential diphtheria, at least in districts and during the seasons in which this disease is prevalent, we shall see fewer cases of post-diphtheritic paralysis than is now, unfortunately, the case.

The presence or absence of K.L.B. in a throat swab is only one of the

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factors that should sway our judgment for or against diphtheria; other signs of almost equal importance being membrane on the tonsils, especially if involving the uvula, enlarged and painful tonsillar or cervical glands with sore throat, continued sore throat that persists in spite of treatment, a low continued pyrexia (although diphtheria with high temperature is common in this country), a white face and small rapid pulse, albumin in the urine, etc.

It is only by careful appraisement of all these factors that one can decide for or against diphtheria in any given case.

There is, in this connection, a golden rule: If in doubt give serum, give enough, *and give it early*.

Some years ago I wrote with considerable trepidation an article calling attention to the prevalence of anomalous cases of diphtheria in the neighbourhood of Secunderabad [1], and insisted on the necessity of early serum treatment in all suspicious cases if we are to escape disaster.

Further experience in another widely separated part of India has only confirmed me in this view and taught me how one must be constantly on the look out for diphtheria in its many disguises if one is to escape its immediate disasters and dangerous sequelæ.

Summary and Conclusions.

(1) The incidence of post-diphtheritic paralysis and other sequelæ of diphtheria has been unduly high, especially amongst officers and their families during the past twelve months, throughout the North-West Frontier Province of India.

(2) At least one case has occurred of typical post-diphtheritic paralysis in a soldier with no antecedent history of sore throat or nasal discharge.

(3) In view of the prevalence of mild non-characteristic diphtheria, all cases of even *mild* sore throat should be looked on as potential diphtheria and should be swabbed, preferably on three successive days.

(4) Every case in the slightest degree clinically suspicious, or which does not react to symptomatic treatment in a few days, should receive *adequate* serum treatment at the earliest opportunity without waiting for positive swabs.

In other words: If in doubt give serum, and give it in adequate amount.

(5) Membrane (at any rate in macroscopic amount) is not a *sine qua non* even in faucial diphtheria, and every case of chronic nasal discharge, especially in children, should be swabbed as a routine.

REFERENCE.

[1] "Diphtheria in Secunderabad," Journal of the Royal Army Medical Corps, October, 1924.

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Editorial.

BRITISH EMPIRE CANCER CAMPAIGN.

THE Grand Council, in presenting their Seventh Annual Report, indicate in brief outline the advances which have been made since the campaign began. At that time research work was carried on by small bands of workers and there was little co-operation between them. Now there is a real campaign, with a headquarter staff, an intelligence department, and a system of co-ordination by which waste of effort is reduced to a minimum and personal relations between workers are fostered.

It has been found possible to produce cancer of the skin and breast in mice with absolute certainty, and in this way a mass of material has become available for those who are investigating the causes of cancer and methods of treatment.

An investigation of carcinogenic agents has been made in many laboratories. It is still widely believed that any sort of chronic irritation of the tissues may predispose to the development of cancer, and that the main determining factor is personal susceptibility. A carcinogenic agent is regarded merely as a convenient means of producing irritation, and study should be mainly directed towards the personal susceptibility which permits the development of cancer. The workers at the Cancer Research Hospital Institute believe, however, that work on the inciting agents is more advisable. They have found that substances closely allied, physically and chemically, produce very different results in the same animal, and they can discover no reason for this. In briquette making and mineral-oil refining, the pitch and crude oil respectively are apt to induce epitheliomata in the workers, while chrome workers, who are exposed to far more irritating substances that cause ulceration, do not develop epithelioma in the exposed parts.

Mayneord and Hieger discovered that many of the distillation products which produce cancer experimentally had a very characteristic fluorescent spectrum, and that many inactive substances did not exhibit this phenomenon. When a beam of ultra-violet light is thrown on a suitable solution of these active substances, the photographic plate shows three characteristic bands in certain positions relative to the lines of the mercury spectrum. This test has proved very useful as a preliminary indication of cancer-producing substances.

Certain industrial products such as coal tar, pitch, crude petroleum, etc., after heating to a high temperature are capable of producing cancer, and it was thought that tobacco when heated might originate a cancer-producing substance. The temperature never surpassed 700° C., a height that may be obtained in a pipe by normal smoking. All the experiments gave negative results. The Birmingham Cancer Committee report that

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experiments were made with tobacco tar produced by Professor Haworth and Dr. Ashley Cooper in the University Chemical Department. The tar so obtained was painted twice weekly for long periods on the backs of mice. Many of the mice survived from eight to twelve months, but in no case has any malignant change due to tobacco tar been seen. In view of the late appearance of cancer, at about 50 years of age, in the human subject, it would be necessary to apply the tobacco tar to mice for at least eighteen months before the conditions could be considered comparable with human cases.

In his work on experimental carcinogenesis Dr. Berenblum found that when two agents capable of producing cancer were applied concurrently to the same area of skin, the result may not be an augmentation of carcinogenesis, but an inhibition. But when each is applied alone for a certain period, a summation of effect is produced.

The anti-carcinogenic action of diethyl sulphide (mustard gas) has been further investigated. Whereas the induction of tumours is inhibited when mustard gas is applied to an area of the skin which is being painted with tar, it has been possible to demonstrate that no such inhibition occurs if the mustard gas be applied elsewhere to a different area of skin. From which it is clear that the mustard gas acts locally on the tissues and not by virtue of tissue immunity. It has been found, however, that the epithelial hyperplasia which invariably develops during the initial stage of a tarring experiment still occurs when the mustard gas is added to the tar, although the ultimate development of tumours is inhibited, so providing an example of a continued state of hyperplasia which does not necessarily develop into neoplasm.

A study has been made of the time relationships of pre-cancerous states in man. It was found that a very high percentage of traumatic cancers are of rapid development, more than one-third occurring in the first five years and over one-half in the first ten years. Many of the rapidly developing traumatic cancers were found in young persons in whom the spontaneous development of epithelioma was unlikely. Of the burn cancers, on the other hand, only one-ninth occurred in the first five years and only one-sixth in the first ten years. Of the cancers following fistulæ and ulcers, none occurred in the first ten years. Nine cases of cancer were observed in war wounds.

Cancer of the bowel is often preceded by a change in the cells lining that organ. A hyperplasia of the epithelium can be recognized in some cases and the possible onset of cancer predicted.

Dr. Thomas Lumsden has been studying tumour immunity for some years, and these long investigations, carried out mainly at the Lister Institute, may be arranged in three groups. In Group I experiments demonstrated (*a*) that anti-cancer sera can be produced which are so specific that they kill cancer cells cultured outside the body in small glass flasks without causing any serious damage to the normal cells cultured along with them ; (*b*) that it is by producing such an anti-serum that an

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animal, e.g., a rat, destroys heterologous tumour cells from a different species, e.g., a mouse, when these are implanted into it ; (*c*) when an animal, e.g., rat, recovers naturally, or as the result of vaccine treatment, from an homologous tumour planted into it from another rat, it does so by producing anti-malignant cell bodies in its serum and by training its white cells to produce a special substance (cytase), which together destroy the cancer cells.

In the experiments of Group II the above principles have been applied to living animals suffering from implanted tumours. It has been shown that if anti-cancer serum, or a dilute solution of formalin, is injected into such a tumour, it not only causes the disappearance of the tumour, but it immunizes the animal so that tumour cells subsequently planted into it fail to grow. This effect is brought about by auto-vaccination. Formalin and anti-serum each have the power to destroy tumour cells in such a way that though they die their chemical constitution is but slightly altered, and when such dying or dead cells, or their products, are absorbed into the general circulation of the animal they give rise to anti-malignant cell bodies and educate the white cells to produce the cytase mentioned above. This method of treatment was first worked out in rats, which have naturally a considerable power of combating the invasion of their tissues by implanted tumour cells.

In order to be certain that there was no fallacy in this conception, it was necessary to show that similar results could be obtained with mice when working with a tumour against which they have no natural resistance. Breast cancer (M 63) when implanted in mice grows progressively in 100 per cent. and can be removed surgically without leaving any resistance behind, so that when re-inoculated it grows as freely as before. The tumour is very virulent and usually kills the mouse in three or four weeks. In spite of this, it has been possible to cure a large proportion of these tumours and leave the mouse immune, so that subsequent inoculations fail to grow.

The experiments of the third group, on which Dr. Lumsden is now engaged, are designed to show whether these methods are applicable to the spontaneously occurring tumours in animals and man. Dr. Lumsden has received from Dr. Simpson, of Buffalo, U.S.A., a strain of mice which spontaneously develop mammary cancer, and has now bred about 1,000 of these mice. The tumours grow slowly, but inevitably cause death in about three or four months, giving rise to secondary metastases in the lungs, etc., just as human tumours do. It is too early yet to say whether auto-vaccination will prove effective in the case of these spontaneous tumours, but there is some hope of success, as American male mice into which these tumours are implanted are more readily cured and immunized by auto-vaccination than the English mice inoculated with breast cancer (M 63).

In Dr. Lumsden's opinion a cancer cure must destroy the existing growth and must immunize the animal and prevent recurrence. Auto-vaccination is an excellent way of obtaining the second requirement, but it is often difficult to destroy completely the existing tumour by the

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measures now employed. Conversely, radium is very effective as regards the destruction of an existing tumour, but it appears to have no immunizing effect, so that recurrence after its use is as frequent as after surgical removal. A large stock of radium is now available at the London Hospital, and it is intended to combine these two curative methods in the hope of retaining the advantages of each. If by preliminary auto-vaccination active immunity can be called forth and the tumour is thereafter destroyed by radium, both the desiderata of a cure for cancer may be forthcoming. Investigations along these lines with human subjects will be commenced, if it can be shown that such methods are effective in the case of the spontaneous tumours of the American tumour-bearing mice.

A great deal of work has been devoted to the biochemistry of cancerous growths. It was thought that there might be a definite chemical difference between the growth of normal tissue and the growth of tumours. Professor Warburg has shown that during the growth of the cancer cell there is an excessive formation of lactic acid. In the Research Laboratories of the Middlesex Hospital it has been found that sodium fluoride checks the formation of lactic acid and has a pronounced inhibitory effect on the abnormal chemical changes in cancer. Its action on human and other tumours is at present being studied. The presence of lactic acid in the stomach has also been studied by the fractional test meal and other methods. But the observations seem to prove that the presence of lactic acid in the gastric contents is of no diagnostic value for carcinoma. It has been found in both malignant and non-malignant cases, and occurs in larger quantities when there is obstruction.

At the Sheffield University, Professor Mellanby reports that the cancer investigations fall into two groups: (1) an examination of the chemical changes taking place in cancerous tissue, and (2) an examination of the effect of diet and other factors in the growth of tumours in mice. Warburg's observation that cancerous growths break down dextrose into lactic acid in the presence or absence of oxygen has been used to determine how the life of cancerous tissue can be influenced by chemical agents normally found in the small intestine. Important results have been obtained from the study of the pancreas and pancreatic juice. It has been found that extracts of pancreas have a powerful action in stopping the production of lactic acid from sugar. The inhibiting agent was found to be amylase, the substance responsible for the digestion of starch. Other sources of amylase, such as the salivary glands and saliva, taka-diastase and malt diastase have also the same action on cancerous growths.

Further work has shown that the mechanism of the production of lactic acid in cancer is quite different from that which takes place in muscle. In muscle sugars pass through an intermediate stage and are built up to hexose-phosphoric acid compounds before being broken down to lactic acid, whereas it appears that cancer cells can break down sugar directly without any intermediate phosphate stage. Although the results are of an

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academic nature, they are of profound significance and may offer at any time a practical method of attacking the disease in a direction not previously thought of.

Dr. Watson has studied the effects of diet and other factors on the initiation and growth of cancerous tumours. Groups of mice have been maintained on different diets and under different experimental conditions for about twelve months, and the effect on the development of tar tumours observed. Care was taken to ensure that any inhibiting effect of a particular diet on the growth of the tumours was not producing its inhibition by adversely affecting the general health of the animals. It has been possible to show by means of these experiments that the development of tar tumours in mice depends on the easy access of the tar to the reacting skin cells. In ordinary conditions it seems that the tar reaches the cells owing to its solubility in skin fat. If the fat is increased by applying the same type of fat obtained from other mice to the skin before applying the tar, then the cancerous reaction is strikingly increased. It has also been found that the increase or removal of the superficial fat not only increases or reduces the skin tumours in tarred mice, but also that a similar effect is produced on the tumours found in the lungs. Some of these are secondary to the skin tumours and some are of an adenomatous nature; in both cases, however, increase and reduction of the primary skin tumours result in increase or decrease of the numbers and frequently the size of the lung tumours.

In the Department of Experimental Pathology and Cancer Research of the University of Leeds, Dr. Young has continued his work on the proliferation of epithelial cells, and has found a remarkable parallelism between the circumstances which regulate the precipitation of negatively-charged colloids on the one hand, and the biological processes of epithelial hyperplasia on the other. The experiments were designed to elucidate the action of metals on living cells. Mercury is the most potent, closely followed by silver; copper is less efficient, though it occasions marked proliferation in adequate doses. Cadmium, lead and zinc are progressively less efficient in that order. It is clear that valency is not the property which dominates the efficiency of a metal in the production of epithelial hyperplasia. It appears that electro-kinetic processes are involved in the cellular reaction, and that possibly a precipitation of the colloids of the cell membrane is an essential phase in the sequence of changes which culminate in cell division.

A large number of reports have been presented to the Grand Council dealing with treatment by means of radium and with research work on the action of the gamma rays on normal and cancer cells.

The tendency of those employing radium as a therapeutic agent seems to be to use smaller doses with increased screening over longer periods, as it is found that by this means better results are obtained both as regards the disappearance of tumours and the preservation of normal tissues from injury. Some of the best results are obtained by interstitial needling of

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the base and edges of the growth combined with surface treatment by radium held in position by shields made of wax. The best results have been obtained in cancer of the cervix uteri, and good results are reported in the treatment of the pharynx, tongue and mouth. Since cancer of the womb accounts for one-fifth of the cancer mortality in women, and cancer of the mouth for one-tenth of the cancer mortality in men, the Council say it is now clear that there should be a substantial drop in the mortality (from cancer) of both sexes as soon as the public learn to take full advantage of the method of treatment at the earliest possible moment.

Radium is also being used in the treatment of cancer of the breast, and the reports of this work are stated to be hopeful. In other parts of the body the results are less satisfactory, but those obtained in the treatment of cancer of the rectum are more satisfactory than last year.

Very careful technique is necessary if the best results are to be obtained. While in many cases surgery still offers the best chance of absolute cure, there can be no doubt that the results of radium treatment are steadily improving, and in three areas, namely, the skin, cervix uteri and floor of the mouth, the results are better than those obtained by operation.

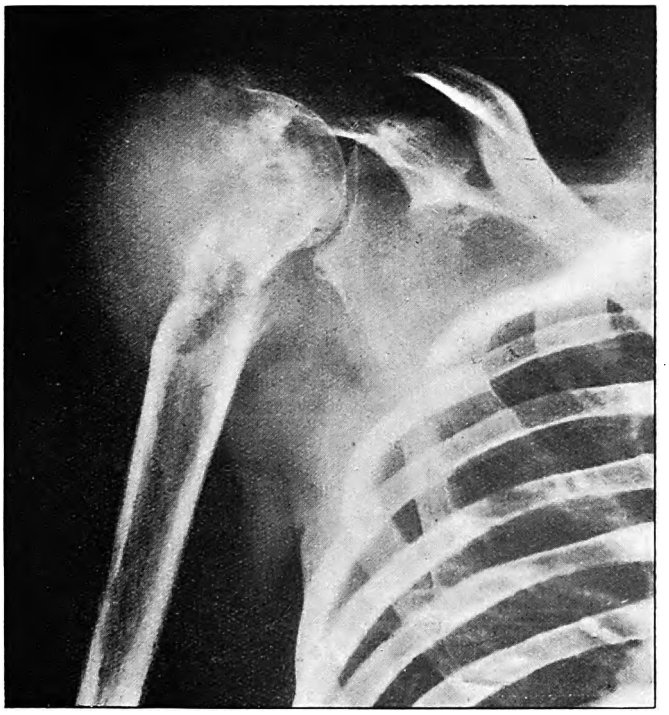
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Clinical and other Notes.

BONE TUMOURS.

By Major E. V. WHITBY,
Royal Army Medical Corps.

During the past twelve months four cases of bone tumour have been under radiological examination at the Queen Alexandra Military Hospital, Millbank. These cases represent different varieties of new growth, and are considered to be of sufficient interest to merit recording.



Case 1.—Endosteal Sarcoma.

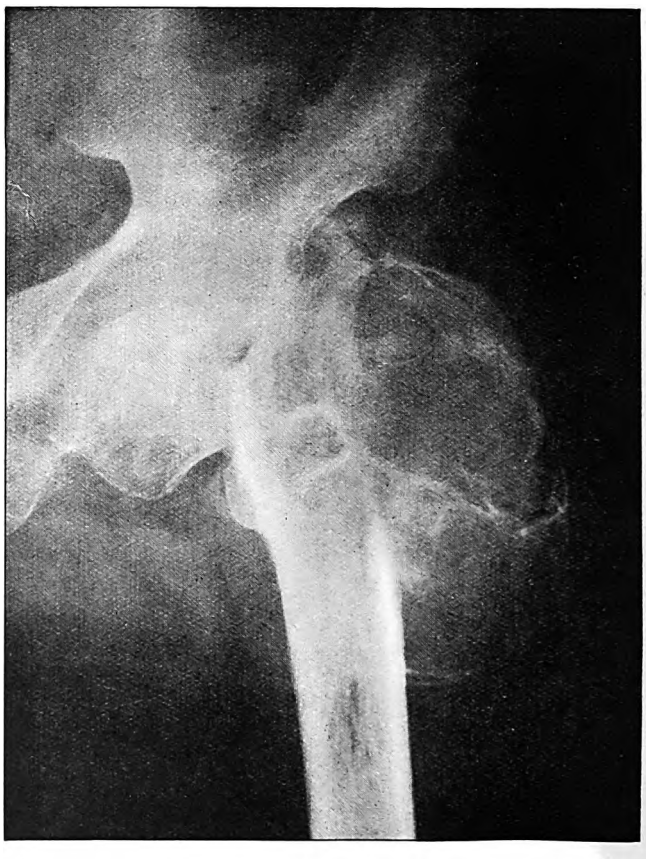
Case 1.—Endosteal sarcoma.
Case 2.—Myeloid sarcoma.
Case 3.—Periosteal sarcoma.
Case 4.—Hypernephroma.

They were good examples of the conditions enumerated, but it must always be remembered that new growths may assume different appearances depending upon the stage of their growth.

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In many cases it is impossible to base a diagnosis on the radiographic findings alone. In making deductions an analysis of the radiographic findings should be made in conjunction with the clinical examination.

In the diagnosis of bone tumours the crucial question is to decide whether they are malignant or not. An all-important sign of malignancy is the rate of growth.



Case 2.—Myeloid Sarcoma.

The following diagnostic points should be kept in mind when a film is being examined:—

(*a*) Point of origin.
(*b*) Bone production.
(*c*) Condition of cortex.
(*d*) Invasion. (Malignancy depends on this.)
(*e*) Laws of probability (age, sex, bone involved).

Carcinoma of bone is always metastatic, for there is no epithelial structure in bone.

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CASE I.—ENDOSTEAL SARCOMA.

A primary growth involving the upper end of the shaft of the humerus.

(*a*) Medullary in origin.
(*b*) No bone production. "A bone eater."
(*c*) Cortex destroyed.
(*d*) Very invasive. (Both bone and soft tissues.)
(*e*) Male, aged 25.

Characterized by rapid destruction of bone from within.
Articular surface escapes destruction.
Note pathological fracture.

CASE 2.—MYELOID SARCOMA

A primary growth involving the upper end of the shaft and neck of femur.

(*a*) Medullary in origin.
(*b*) New periosteal bone laid down at periphery of tumour.
(*c*) Cortex destroyed. Expansion is apparent, not real.
(*d*) Invasive.
(*e*) Male, aged 20.

A slow growing giant-cell endosteal tumour. Growth starts in medulla and destroys it. Pressure erosion of cortex from within results in destruction. Pressure on periosteum from within gives rise to irritation which causes new bone formation. New bone is destroyed by pressure and more new bone is laid down by periosteum outside it.

The trabeculation is due to the uneven pressure exerted by the growth. (Gilbert Scott.)

A pathological fracture in this case was the first indication of the existence of a new growth.

CASE III.—PERIOSTEAL SARCOMA.

A primary growth involving the shaft of the femur.

(*a*) Periosteal in origin.
(*b*) Bone production present. Striæ of new bone laid down in soft tissues perpendicular to shaft.
(*c*) Very invasive. Greatest growth in the soft tissues.
(*d*) Cortex not destroyed, is irregular and worm-eaten in appearance.
(*e*) Male, aged 20.

Growth probably originated in the deep layer of the periosteum as the cortex shows evidence of invasion.

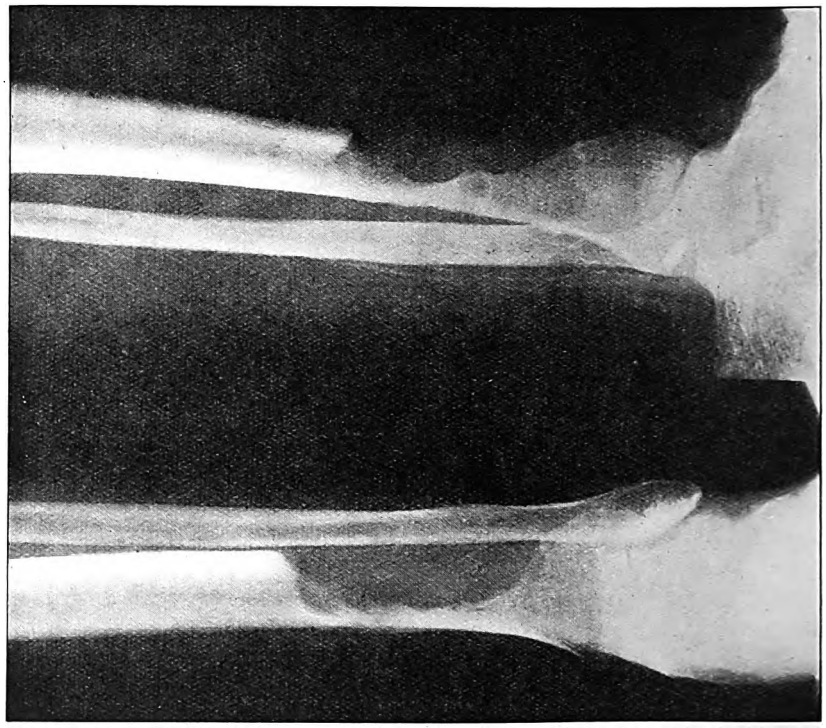
Patient died with extensive metastases in pelvis, spine and sternum.

CASE IV.—HYPERNEPHROMA.

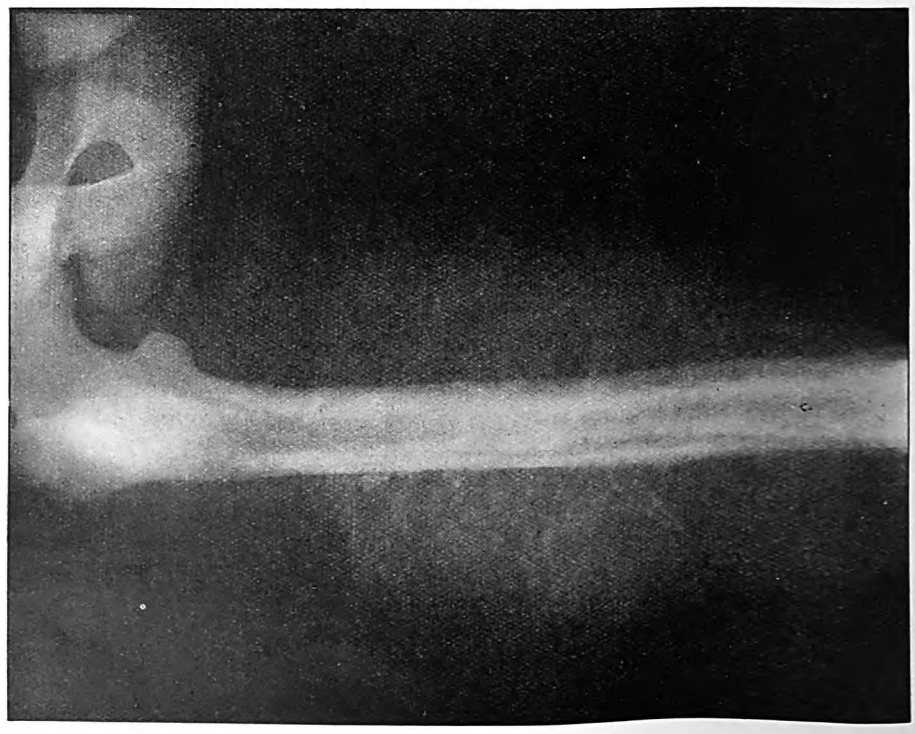
A secondary growth involving the lower third of the shaft of the tibia.

(*a*) Medullary in origin.
(*b*) No bone production (on account of rapidity of growth).

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Case 4.—Hypernephroma.



Case 8.—Periosteal Sarcoma.

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(*c*) Cortex destroyed.
(*d*) Very invasive. A "bone eater."
(*e*) Male, aged 70.

Antero-posterior and profile views. The shadows in the soft tissues are due to calcification of the arteries.

At post-mortem a large tumour of the right kidney was found. "Tumour of Grawitz."

I am indebted to Colonel E. Ryan, C.M.G, D.S.O., K.H.P., for permission to publish these cases.

A CASE OF POLYMASTIA.

By Captain C. E. ECCLES,
Royal Army Medical Corps.

Mrs. A. was admitted to the Family Hospital at Dagshai on June 8, 1930. She was confined on June 9, her fourth pregnancy.

The day following her confinement she complained of swellings in both her axillæ.

These swellings were nodular, and in consistency felt like mammary tissue; the largest one was about the size of a hen's egg. The swellings were painless but slightly tender on palpation, those in the right axilla were noticed to be larger than those in the left axilla.

The patient was feeding her baby at the breast, and during the actual period of feeding the swellings in both her axillæ increased in size and became painful.

It would appear that during this period these swellings became filled with milk; when the breasts were emptied they decreased in size, but they have always been palpable.

Patient states that she first noticed these lumps after her second confinement, and the same condition has followed each subsequent confinement.

The lumps never absolutely disappear, but are always just palpable. She has never noticed their increase in size during her menstruation.

Both the patient's sisters have suffered from the same complaint after their confinements. The patient is a perfectly healthy individual and has never been seriously ill.

There are no enlargements of any other glands. I saw the patient one month after her confinement; she still complains of the swellings in her axillæ, but she states that they are improving slowly. She also states that each time the baby is put to the breast the lumps show a decided increase in size.

It would appear that this condition is due to an extension of mammary tissue into the axillæ, and at feeding times the milk is secreted, causing the lumps to increase in size.

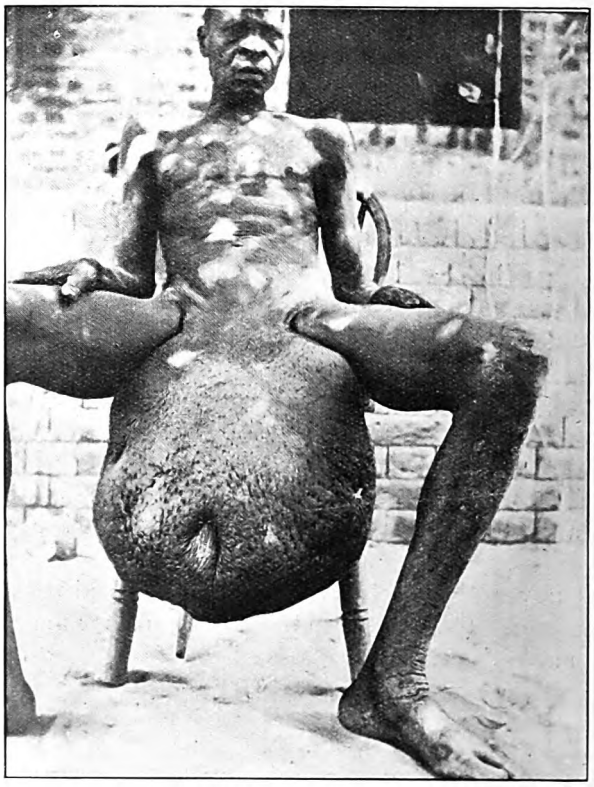
Although several such cases have been recorded, it is considered that they are sufficiently few to justify bringing the above case to notice.

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A CASE OF ELEPHANTIASIS SCROTI FROM DARFUR, SUDAN.

By Lieutenant L. R. H. KEATINGE,
Royal Army Medical Corps.

The patient was discovered in a distant part of the Province, and was persuaded, with difficulty, to come in to Headquarters for operation. He complained of inconvenience only. The tumour, when the man stood up, reached about two inches below his knees, and the penis had been invaginated for twelve years, according to the history. The patient was very emaciated.



Operation.—A square flap for the re-covering of the penis was made. It started at the level of the pubic bone, and extended downwards for about five inches.

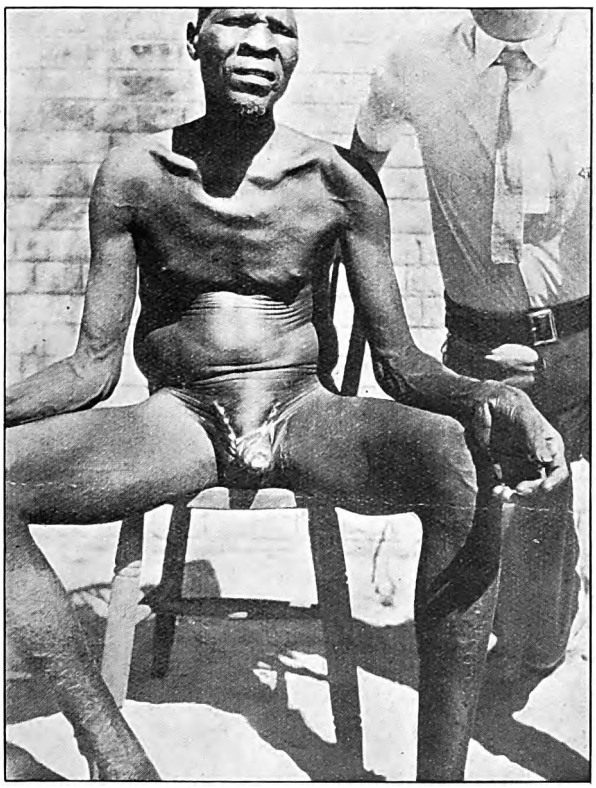
Two semicircular incisions were then made, extending on each side from the median raphe, about one inch above the anus, to the bases of the lateral incisions of the square flap. The skin thus outlined was dissected

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back to the thigh, and cleaned of diseased tissue. The flaps so formed were for the reconstitution of the scrotum.

The testicles, which were perfectly healthy, and the penis were then identified and cleaned. They were laid in saline on the abdomen. The tumour was then removed.

The two semicircular flaps were then stitched together with interrupted silkworm sutures, and the testicles were placed in the bag so formed. The penis was then covered by the square flap, which was also stitched to the new scrotum.



The tumour weighed 48 pounds.

There was a considerable amount of sloughing from the diseased tissue which remained, but the patient made steady progress towards recovery, and left the hospital after some six weeks with his wounds completely healed and his disability cured.

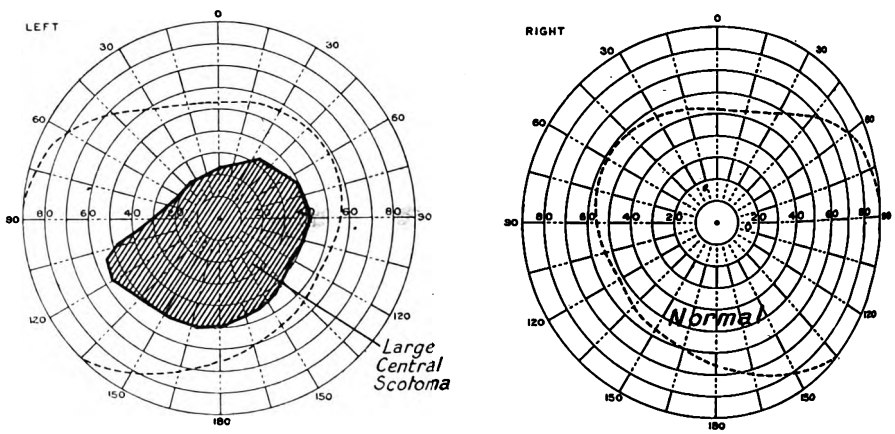
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UNILATERAL AMBLYOPIA DUE TO CENTRAL CHOROIDO-RETINITIS, AND RECOVERY.

By Major J. A. BENNETT,
Royal Army Medical Corps.

Private A. reported sick, complaining of blindness in the left eye of about fourteen days' duration. He stated that "it came on its own," and that there was no history of injury; further, regarding the duration, he was doubtful and could not fix a definite time when the condition was first noticed by him.





Left fundus, direct view.

There is nothing relevant in his medical history sheet, and he denies having suffered from venereal disease.

Aged 31, but he looks much older and has thirteen years' service.

The pupils are equal. The left contracts to direct light stimulus, and with continued light stimulus sluggishly dilates again. Consensual reflex present. The right pupil responds to direct light stimulus but not consensually. Eye movements are normal.

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Right vision = $\frac{6}{6}$. Left eye vision = $\frac{4}{60}$, and then only peripheral. When the eye is directed downwards there is no vision centrally.

Ophthalmoscopic examination reveals choroido-retinitis with migration of pigment which is occupying the macular region in particular, although scattered foci are seen all over the retina and one larger focus above the disc. The condition seen is as shown in the sketch, and is probably a form of disseminated choroiditis, described by Förster, in an early stage.

The right fundus is normal. The field of vision is shown in the accompanying charts. Blood was taken for Wassermann test and found to be strongly positive.

Anti-syphilitic course was started. Sulfarsenol and bismostab.

In five days' time central vision returned, and he could read $\frac{6}{24}$. In ten days it was $\frac{6}{18}$, and on discharge from hospital $\frac{6}{9}$ (partly), and the condition in the left fundus appeared to have partially resolved.

On further examination a healed abrasion was found on the penis, but no other evidence of syphilis beyond the strongly positive Wassermann reaction; the condition probably being a late secondary manifestation.

The response to anti-syphilitic treatment clinches the cause of the condition and shows the paramount importance of early diagnosis and treatment in such a case.

Travel.

EASTWARDS HOME FROM INDIA.

By Major L. B. CLARKE,
Royal Army Medical Corps.

(*Continued from p.* 314.)

The journey across the continent of America was of exceptional interest, both for the organization of the railway and the variety of country traversed. The C.P.R. run in the winter three daily transcontinental trains, and in the summer this number is increased to five. The Company had just completed for this service the building of fifteen new trains at a cost of a million dollars each. One had heard of the new rolling stock, but realization far exceeded anticipation, and in the Trans-Canada, the fastest of these trains, one found everything that conduces to the safety, comfort and entertainment of a long journey. There were eight "all steel" cars of enormous length; a berth was secured in a reserved sleeping compartment which holds two beds. Everything was brand new and highly polished, in fact, the train was on its second eastward run. A large bed with spiral spring mattress was made from the two opposite seats, the upper bed was tucked away in the roof and not used, there was a silver-plated wash-basin, complete with hot and cold water, drinking water and iced water were laid

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on, and above the basin was a silver-plated dressing mirror with adjustable side-pieces. Electric switches are out of date; here one presses a small button in the wall, and in the dark it is located by a phosphorescent glow of luminous paint like a fire-fly of the tropics. A dining-car in front was noteworthy for its magnificence of design and decoration, the newness of its English silver, cutlery and china. All food is *à la carte*, the amount served with each course overwhelms one, and so does the bill. Food is undoubtedly expensive in Canada, and even with economy an ordinary breakfast in the Trans-Canada costs about 8s. In this democratic dominion one was intrigued to notice that where breakfast and lunch were served

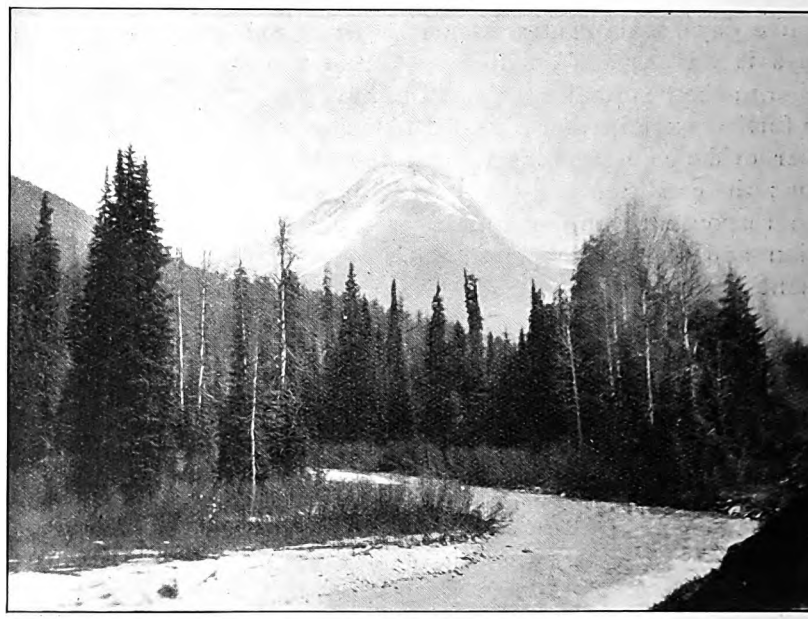


FIG. 1.—Canadian Rockies.

under ordinary names, dinner was invariably called "evening meal," although it might be partaken of in a dining car.

At the back of the train was an up-to-date observation car of great length, the first half being devoted to buffet, barber, manicure, writing room and library, while the second part consisted of a club room with soft leather arm-chairs, and behind this again a compartment of equal size called the solarium. Here windows of vita glass running from floor to ceiling enabled one to obtain the maximum of light and view. For the journey over the Rockies an additional observation car is run behind this, and instead of a closed car one enters an open one with a small covered compartment in the middle, a refuge from the oil smoke of the long tunnels.

We left Vancouver on the Sunday evening at 6.30 and pulled silently out of the station with that quiet efficiency which is so characteristic

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of the C.P.R. A full moon enabled one to see a good deal of country normally passed in darkness. A long winding river with the line conforming to the curves, the banks gradually rising, the steady throb of the engine, an increasing gradient, steep cliffs becoming steeper and then vertical and we entered a long winding canyon, the moon throwing up into weird relief and exaggerating the rugged contour and irregular outline of a narrow chasm. Next morning we were well up in the higher levels of the Selkirk Range, on all sides were scenes of the greatest interest, and as the train in snake-like fashion twisted in and out of winding defiles one saw rising above one snow-capped summits of considerable height. Then

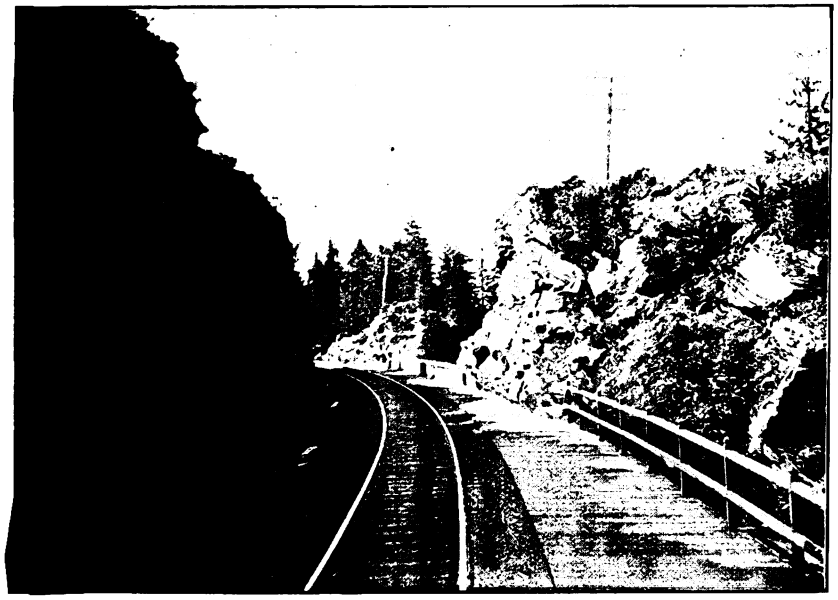


FIG. 2.—Canadian Rockies.

dropping down again to lower ground the train ran alongside a great river, over many lofty bridges and small culverts, and after many miles of winding valley gradually left the river and commenced the long ascent of the Rockies. The train climbed for many hours, the line running on a narrow ledge cut out of the mountain side, through lengthy tunnels and over viaducts whose height made one dizzy, and then came to rest at the foot of a wide and extensive pass. Here oil engines were attached to the train and the journey was continued.

The line took the middle of a wide and deep valley with mountains rising above to the height of about 10,000 feet, mighty snow-covered peaks whose vertical surfaces, bare of snow, showed a mellow brown against a clear blue sky of early summer. One is tempted to compare such scenery with that of other countries. India has mountains on

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a grander scale, the Balkans afford longer distance views, the Alps contain more variety, the Japanese mountains are diminutive and dainty, Scotland has a charm of her own, but the Canadian Rockies have a peculiar characteristic—an ethereal effect of something unreal, and one somehow cannot appreciate the fact that these too are composed of so much rock, they appear to be more the subtle shades of an artist's picture or the delicate tracery of some cathedral window.

The line now enters a long spiral tunnel, the exit being immediately above the entrance, now seen far below. The ascent was continued, more tunnels passed, and soon we reached the summit at a height of about 5,000 feet. This is called the Great Divide and forms the boundary between British Columbia and Alberta, and here also is the watershed of the great system of the Rockies, the mountain rivulets on one side being

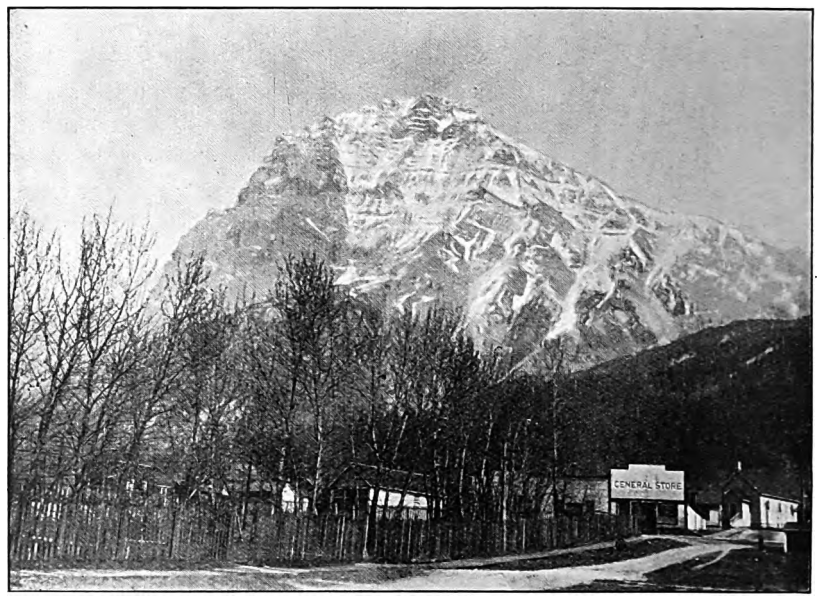


FIG. 3.—Mount Stephen, Canadian Rockies.

destined for the Pacific and on the other for the Atlantic. For several hours the Trans-Canada thundered her way downhill till late in the evening Calgary, the most western city of the Prairies, was reached, and the Rockies became merely the silhouette of a summer sunset.

One heard in this part a good deal of the recent discovery of oil, and great hopes were expressed of its providing Alberta with a new industry and great wealth. Anyhow, nearly everyone who had money to invest, and many who hadn't, were speculating heavily.

All next day we were running through the Prairies, great stretches of nearly flat country with dark soil through which the young green shoots of the early crops were just appearing, and farms and homesteads and small

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settlements passed rapidly by. Here was no suggestion of the wild west ; it appeared very civilized and one noted that as far as one could tell from the railway, although distances might be great, there were no isolated farms. One was scarcely out of sight of human habitation, a contrast to the previous day in the Rockies, and the following in the land of lakes and woods. The Trans-Canada continued on her way, reaching a speed well above seventy miles an hour and maintained it for long distances.

By evening we reached Winnipeg, the great wheat city of the central plains, and made our longest stop, half an hour, for no time is wasted on this train. The next morning we passed through Port Arthur on Lake Superior, and then alongside the northern shore of this vast inland sea. The whole morning was spent traversing this region, and the views of the coast as we wound in and out through the rocky defiles and alongside brown-coloured sandy shores was one of pleasant change to the monotony of the prairies. The whole afternoon and evening were spent in that fascinating country known as the lakes and woods, country of almost virgin fir-tree forest and winding lakes where people and houses are almost non-existent. Here one felt was the true wild west, for many years must elapse before this country can be populated. Forest fires on a great scale cause much loss of valuable timber, and everywhere are warnings regarding cigarette ends and lighted matches. Even with all these precautions fires still occur, and one is told that they may break out miles away from any human being, and it is suggested that in the hot dry season they are caused by spontaneous combustion or the heat generated by the friction of a falling rock. Nowadays the forest authorities employ fleets of sea-planes which have their bases on the lakes and can patrol over great areas and so report the earliest signs of any conflagration.

At 7.40 on the morning of the fourth day the Trans-Canada steamed into Toronto Station, having completed 2,700 miles from Vancouver in eighty-one hours ten minutes. (The clock had been advanced three times.) Here on the shores of Lake Ontario, where in olden times the colonists from the north met and exchanged goods with the Indians from the south, is a vast modern city growing year by year in size and prosperity. Considerable ground has recently been recovered from the lake and added to the city, and here docks, warehouses and public buildings and a vast pleasure resort have been constructed.

One's first impression of Toronto was that it was very militaristic, officers and men in uniform being much in evidence in the streets and hotels. This seemed rather surprising in a democratic dominion, but the explanation was that a military tournament was being held in the town. It was a performance well worth seeing and was nearly as good as that of the Royal Tournament.

Across the water can be seen on a clear day the outline of the Canadian and United States shores, between which the Niagara River enters Lake Ontario. A short run of eighty miles, a free side trip on the through

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C.P.R. ticket, brought one to Niagara Falls. One changed from the Toronto-New York Express at a junction close to the Falls. In the small smoking compartment at the end of the train two Americans beguiled the tedium of travelling by narrating at great length and in graphic detail the various symptoms of their respective gastric ulcers. Each produced a dietary and they compared notes to their mutual satisfaction. They had consulted numerous specialists in numerous subjects; up to six in number they were even, after this one man fell out and the other who had been examined by ten won handsomely. The fact that they did not realize that they had a medical listener added piquancy to the situation. The next day at Toronto two other Americans sitting in the hotel lounge were also heard discussing their gastric ulcers, and one began to wonder if four U.S. citizens encountered out of four suffer from this condition, what must be the incidence in America?

Niagara Falls came completely up to expectations. One was prepared to be disappointed, but this was far from being the case. Everything is on the grand scale. The great volume of water resembling a gigantic column of green marble, the width of the falls, the depth of the lower river and the extensive views seize the imagination, hold one's attention and impress one's memory for all time.

The Canadian side is beautifully kept with parks and gardens and public buildings. By comparison the opposite shore is commercial, tawdry and uninteresting. An elevator takes one down to the lower level of the Falls, and here one dons a sou'wester and gum boots and enters a long tunnel in the rock which takes one first to the side of the Falls, and later through small traverses actually under and behind the great wall of water. The view from the side is very impressive, as one is within about twenty feet of the edge, and from this point one obtains an accurate idea of the size of things. The traverses leading behind are less interesting. It is merely the effect of a monsoon day in Burma, but the sound of the roaring water strikes fear into the heart of many.

There is much of interest at Niagara, the place where Webb lost his life, the great football in which a man survived the passage of the Falls, the railway and road bridges, so eroded by spray that new ones are required every ten years, the trolley suspended from a wire rope across the lower river on which a tight rope walker poised in mid-air once cooked and consumed an omelet, and the new power station of classic Greek design which relays electric power over a considerable portion of the province of Ontario.

Perhaps the most interesting relics to be seen at the present day are two derelict rum-runners which came to grief a few years ago above the Falls, and there, firmly secured by the rocks, remain as permanent memorials to the liquor laws of two countries. In each case the crew was saved by a rocket and life-line, but the cargo remains intact and unapproachable.

The next day was spent in exploring Toronto and visiting the

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University, the Medical School, where insulin was discovered, the Parliament House, the residential district of Rosedale, and the "sea-side" resort of Sunnyside on land reclaimed from Lake Ontario.

The journey onwards to Montreal, 375 miles, was in the "Canadian," a through express from Chicago, and the chief features were interesting lake-side views and quaint villages, and in the later stages the French appearance of the places and people. Montreal with its million population is two-thirds French in race, language and religion. One senses the French atmosphere everywhere. The whole scene is reminiscent of France, the churches, convents, nuns, school children and so on; in fact it is almost more French than present-day France, for here under the British flag is more religious freedom than in the country of their origin, and many of their manners and customs have been handed down unchanged through the ages.

Montreal with its strange mixture of modern city and old provincial France stands in unique position between the towering heights of Mount Royal and the wide stretches of St. Lawrence River. The views from the hill are very extensive, and across the river can be seen the American boundary, and to the north a vast undeveloped country of rolling downs.

In the morning various places of interest were seen, the French quarter, the McGill University, Notre Dame and the docks. In the afternoon a run of about thirty miles included a visit to Lachine Rapids, named by Cartier on his historic voyage of discovery up the St. Lawrence, who in his endeavour to find a way to the East thought he had reached China and so named the falls, which at the present day bear a somewhat inappropriate name. The car crossed over a ferry to the opposite shore and the Indian reservation was entered. This is an area set aside for the North American Indian, where in several small villages the aboriginals are encouraged by the Government to make "arts and crafts," a disappointing place, for one saw none of the old-time costumes of the scalp hunters of one's childhood books. The inhabitants wear the prosaic garb of civilization, but their features are unmistakably Indian. The return to Montreal was made via La Prairie and the great bridge over the St. Lawrence. The evening was spent with friends in their house on the lower slopes of Mount Royal, and one heard much of interest concerning Canada.

The journey to Quebec, 170 miles, in the "Frontenac" Express, took one through wild open country, past occasional villages, through one town of some size, Trois Rivieres, and finally along the foothills of the great Laurentian Mountain chain.

Quebec is essentially a city of antiquity, quaint old-fashioned houses with narrow winding streets, steep hills, sharp corners and even more French than Montreal. The only building of really modern type, apart from the House of Parliament, is the C.P.R. hotel, the Château Frontenac, situated on the cliffs dominating the St. Lawrence, and this is designed in the French château style with white towers and turrets. The Citadel lies

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to one side, and beyond this is the great open space known as the Heights of Abraham, where Wolf, after many sailings to and fro, seized his opportunity, scaled the cliffs, defeated the French garrison and so secured to the Empire the dominance of the North American Continent. Quebec in the month of May looks very charming and picturesque, the long winter is over and summer is at hand.

The last stage in a 15,500 miles journey was commenced, and the Atlantic crossing was made by the "Empress of Scotland," the largest of the C.P.R. fleet, originally the old German liner the "Kaiserin Augusta Victoria." The weather down the St. Lawrence was cold and bleak. Newfoundland was passed after two days, and as we entered the Grand Banks fog was encountered and the ship stopped. For the next twenty-four hours we were completely enveloped in drifting fog, and the ship proceeding at about four to five knots stopped very frequently. Just after lunch the engines were suddenly reversed at full speed and collision with an iceberg averted by a matter of yards. Drifting fog and icebergs are not pleasant company, and for many hours we passed through unpleasant conditions. Early in the evening one was able to see about one hundred yards away a great mountainous iceberg slowly rising and falling in the swell.

The next day all was clear, full steam ahead was ordered, the Gulf Stream was entered, the weather became warm and pleasant, the sea dead calm, and as the days passed the sun gradually increased in intensity. On the morning of the eighth day the welcome sight of the Lizard made one realize that the Atlantic crossing was over and one had completed a circuit of the globe. The Channel Islands were passed at sunset and Cherbourg reached at night.

The Channel the next day was in a fair mood, and as the Empress liner passed slowly up the Solent on her way to Southampton planes of the Royal Air Force circled close overhead and gave welcome to many people from distant lands—and a few hours later in a London theatre the curtain rose on "Journey's End."

Echoes of the Past.

THE REMINISCENCES OF AN ARMY SURGEON.

By Lieutenant-Colonel W. A. MORRIS,
Royal Army Medical Corps (Ret.).

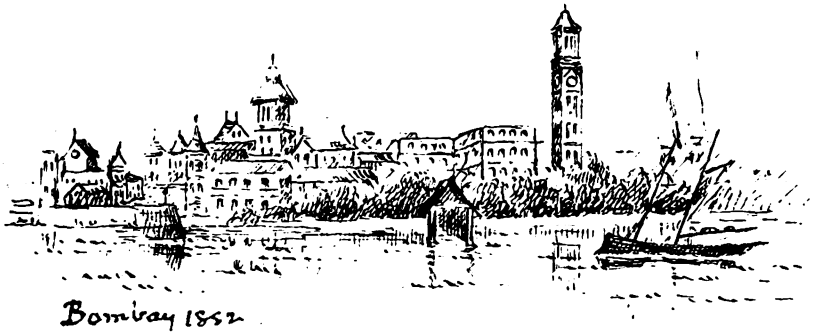
(*Continued from p.* 149.)

At first sight Bombay appears to be very flat, and only a small part of the town could be seen in 1882, but thirty years later it presented a much more imposing picture with its public buildings, magnificent hotels and frontage.

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The ship anchored in the middle of the harbour, not far from the H.M.S. "Magdala" and "Tigris." A black-funnelled P. & O. could be distinguished higher up, but there was no ship spproaching the capacity and smart appearance of H.M.S. "Euphrates," with a tonnage of about 6,000. We were immediately surrounded by a multitude of natives looking for places as servants. They were plentifully supplied with "chits," which are letters from their former employers describing their powers in their art and their conduct. These could be bought or borrowed in the bazaar, but many were quite genuine. At the same time it is necessary to be wary in a port like Bombay, and better to have a servant sent down from your mess to meet you.

The morning was fully occupied in getting the troops off to the lighters and transferring them to the Apollo Bandar or quay.



The name Apollo Bandar is confusing, as "bandar" simply means a monkey. The story of this title turns on a former Indian civilian of eminence, who had very plain features, but was in every other respect unrivalled. When he was Lieutenant-Governor of Bengal, and his official residence was known as "Belvedere," some wag called him the "Apollo Belvedere." Later he was transferred in a similar capacity to Bombay, and the duty of opening the new landing stage fell to him. These quays by the river are called "bundars," so here was an opening ready made, and the landing stage was called the Apollo Bandar, and completed the joke.

I remember once, when returning home and waiting on the quay while the troops were embarked on lighters and moved to the ship that the last lighter, on which I embarked, was filled and just moving off, when a staff officer "spotted" a solitary figure in white, and hailed him without obtaining a satisfactory reply. So, jumping on shore, he went to this man but could make nothing of him, and I was called. I asked him tactfully who he was, when he burst out in a sad and injured tone, "I be the lunatic," and so he was, but of the mildest type, whose guard had slipped off to have a drink. We took charge of the poor man, and the guard joined later by boat at their own expense. This lunatic later made a wild jump from the exercising station into the Indian Ocean, but was rescued after much

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inconvenience and delay. It appears that he got under the net which is rigged to prevent such accidents.

I took my wife ashore after assembling our luggage with Messrs. Grindlay, the agents, and proceeded to report myself, but before doing this I marched a party off to the Colaba Hospital. On reporting my arrival I was informed that no orders for me had yet arrived, and that I must wait till they came. We were not sorry, for everything was pleasant, full of colour and interest, and my wife soon had her sketch book out and her clever hands at work. We took rooms in Watson's Hotel and employed our first servant, a fine rascal, who remained with us a very short time.

We made our way to the hotel on the Esplanade, where it occupied a fine position, and was the principal rendezvous of the European officials and travellers. It was well-managed, and dinner on the arrival of a troopship or a P. & O. liner was often an elaborate affair, and sometimes brilliant. On these occasions the ladies turned out beautifully, their dresses with the varied uniforms making a splendid sight. After dinner the company would parade up and down the spacious verandah in front of the dining-room. In every way the *mise-en-scène* was most attractive and cannot be forgotten.

It was here that first arrivals in the country tasted the delicious pomfret and Bombay oysters carefully and skilfully prepared by native cooks, while the service by Goa boys was perfect. We quickly made the close acquaintance of the mosquito, as we did not know the usual precautions to ward off this pest.

There were French windows to our room leading on to a small balcony, where we had early tea and watched people passing below. Some of the costumes were very quaint, notably those of the Parsees, with very full white shirts, and papier mâché hats of a peculiar shape, sometimes round and flat, but quite distinct from the native head-dress.

Later I received orders to proceed to Allahabad and report to the P.M.O. of that district. Allahabad was my first station in India, and I entered it on January 15, 1883. It was also my last when I retired on January 12, 1912.

After the receipt of my orders we drove to the Crawford[1] Gardens, which were well kept and well laid out, some of the creepers and shrubs being very beautiful. Our route included the road round Malabar Hill and point, where the chief offices are placed, and the Bombay aristocracy live in large houses covered by creepers, with neatly laid-out gardens or compounds. The Governor's bungalow was at the extreme point. On our way we passed some rising ground on which are built the Towers of Silence, where the Parsee dead are placed and devoured by vultures. We could see these repulsive birds gorged and roosting on trees or flying lazily

[1] Mr. Crawford was a distinguished Civil Servant who, as Collector or Commissioner at Bombay, completely transformed this city by his improvements and changes.

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about. As we returned we passed through the native bazaar, where the workers in brass and copper plied their trade, and the noise of the hammering was deafening. A sickly odour pervaded this part and we were glad to reach our hotel.

Bombay is pleasantly cooled by the sea breeze which sets towards the land as the sun goes down, and makes a break in the monotony and *ennui* caused by the heat.

I frequently passed through Bombay during my service, but it never had any great attractions for me.

The next day I made out my departure report, obtained my warrant, paid my bill at the Esplanade, entered a comfortable compartment of the train at the Victoria Station, and started for Allahabad, a journey of 900 miles. My wife and I were alone in our compartment and appreciated it. It was cold and we required our warm rugs as the train passed over the Western Ghauts. Travelling by night we missed the curious traprock hills, which abound in the Bombay Presidency. In the early morning we were running down the eastern slopes of the ghauts, and as the day advanced it became warmer.

We passed through miles of jungle to Khandwa, and noticed Fort Assirghur on our left, but otherwise the journey was uneventful, hot and trying. We reached Jubbulpore at 11 p.m., and seven hours later crossed the Jumna bridge at Allahabad and drew up at the railway station.

The platform was crowded with natives all talking at once and making a noise that was bewildering. Collecting our luggage we bent our steps to Laurie's Hotel. The up-country hotels in India at this time were owned and managed by men who had had a career of some note in the Army, in civil life, in the employ of Native princes, or in business of their own, and were usually called by their owners' names.

The hotels I remember in those days were Jackson's at Jubbulpore, Lee's Railway Hotel at Cawnpore, Hill's Hotel at Lucknow, Maiden's Hotel at Delhi, Nedou's in Lahore, Rowbury and Powells' at Rawal Pindi. M. Laurie owned hotels also at Agra and Simla. He was a short, powerfully built man with a distinctly French accent, but where he came from I do not know. He once told me that he had served in the transport service on the Indus, in the Scinde Campaign. Regarding the Mutiny, I found him full of information. He also roused my interest by telling me that cholera was not contagious so long as ordinary precautions were adopted and to prove this, added that on two occasions he woke up in the morning to find his mate, who slept under the same blanket, dead of cholera. Although I took his stories *cum grano*, I found them more or less correct when later I came to grips with that terrible disease. M. Laurie possessed an enormous wife and an enormous family, of whom he was inordinately fond, and he would entertain his guests from time to time with the virtues of his olive branches. He was much liked and respected. Laurie's Hotel was fairly typical of these places in India up to 1900, when they began to

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alter and become westernized. This hotel was large and sunny, surrounded by a wide verandah, and built on a double-storey plan with a flat roof. The entrance was marked by a handsome portico, and passing through this into the hotel there was a shop on the ground floor, and also a room with a resident hairdresser. The articles for sale were interesting and expensive, and consisted of samples of work from Benares, Moradabad, Scinde, etc., and shawls from Agra and Kashmir. Two arches separated this emporium from the drawing-room, and off this and other parts were large airy bedrooms with bathrooms, while outside the compound was alive with traps, horses, birds, fowls, ducks, etc., and at the well in the centre natives were washing. We were well looked after at the rate of eight rupees a day for two of us. It is much more expensive now, but I doubt if there is any real advantage obtained for the extra outlay.

Surgeon-Major McCreery had charge of Akbar's Fort at Allahabad by the site of the Megh Mela or Great Fair, where thousands visit the holy place and bathe in the sacred Ganges. In this Fort also is a very good sample of one of Asoka's pillars. Poor McCreery, after two years' service, died there from the effects of heat. I shall never forget the funeral. The medical officers were Surgeon-Major Boileau, Surgeons Sherman Bigg, Murray Irwin (now Sir Murray), and myself. Doctors in those days had some funny notions regarding dress, and did their best, but in this instance the white uniform confused us. At any rate, the S.M.O. turned up in cloth overalls, white tunic and forage cap, with his belt and pouch hanging over his sacrum; the others turned out better, but incorrectly. Behind us marched Colonel Stokes, R.A., commanding the Station in the absence of the G.O.C., and he noticed our appearance at this parade, and afterwards told us that he would be present at the Station Hospital the following morning. He kept his word and told us off thus: "I have seen many sights in my life, but of all the d——d rarey shows in the world, you are easily the best." We took it good-humouredly, and one of us, Irwin, I expect, was told to look up the matter and get the dress right. The S.M.O. would acquiesce in anything, but his forte was in other directions more scientific than military.

I know nothing of Mr. Jackson, except that he was an old soldier, and possessed a very good hotel at Jubbulpore. I have stayed there a few times, and the first was on my way up country with the East Surrey Regiment from Deolali. In those days we travelled by night and rested by day in camps established by the Railway. The first rest camp after leaving Deolali was Khandwa, and not a popular one, as it was exposed, hot and uncomfortable. The second camp was Sohagpur, situated in the heart of the jungle, near Pachmari. The train was commanded by a Captain Phillips and we fraternized. He had not been in India before, but I had experienced one hot weather, and became his guide and friend. Now, Sohagpur was justly celebrated for its tiger shooting, and I managed to induce Phillips to have a casual shoot. Our idea was to shoot black buck, so we took two

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Martini rifles and some ammunition and, boring a hole in the apex of each bullet, filled it with soap and made a dangerous missile. Mounting two transport ponies, we started off. After covering about four miles, we were told that some fine sambre were about in the forest, and the shikari led us into a dense forest which every now and then opened into a delicious glade, but we saw nothing and understood our position less. We were full of enthusiasm, and any animal, from an elephant to a cat, would have been riddled if our aims were true, for on this important fact we had no misgivings. We pursued our wild, irresponsible march till it became hot. We then rested by a stream, and the shikari pointed out to us some foot impressions or "pugs" of a tiger, and he thought a fairly large one. We then considered that we were in for a shoot, and after lunch we started, clutching our rifles and peering in every direction for a tiger, but were doomed to disappointment, and eventually reached Sohagpur and started for the next rest camp at Jubbulpore, and this brings me back to Jackson's Hotel and the end of this story.

At midday we met at tiffin, and I then explained to my friends and those at table what a disappointing shoot Phillips and I had had the previous day, and that such a chance would never recur—we were almost on the back of a tiger, but our luck was out. Astonishment and surprise were visible, but we had created a considerable impression by our proceedings, till the silence was broken by a gentleman inquiring as to the exact place we had gone to. He also recognized the shikari who accompanied us; inquired what battery we had, and our former experience. Our reply astounded him, and he told us that we had been in a place full of tigers, and we were very lucky in not meeting one. He then read us a lecture and told us his name was Scott, and that he was Deputy Commissioner of the District, and in fact was a well-known shot. Phillips and I were glad to escape from Jackson's Hotel the same evening, and run to the next camp at Allahabad.

Serjeant Lee owned the Railway Hotel at Cawnpore, and was the principal guide to the places of Mutiny interest. He drove the visitors round in a waggonette, described the incidents eloquently in a sad, low voice, and his emotion increased till it culminated at the slaughter house, when he brushed the tears from his eyes. He did his part efficiently, and it was possible to picture his prowess in every scene, but as a matter of fact he had not been present. He was an enterprising man and popular.

Mr. Hill, of Lucknow, had been the Riding Master of the Queen's Bays, and settled in India in the sixties of the last century. The first time I stayed at his hotel he told me that Sir William Gull was recommending his patients to drink whisky and forego brandy. "Brandy pawnee" was the main drink till about this time. Mr. Hill had a large quantity of whisky of the very best brand, and sold it at two rupees a bottle. In the hot weather he went to his hotel at Naini Tal, and very often would be seen dressed in his regimentals, with overalls strapped, riding round the lake on a well-groomed pony.

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Mr. Nedou owned the principal hotels in Lahore and Kashmir for fifty or sixty years. I knew him well and liked him very much. I was sorry to hear that he died recently. He must have reached a great age.

Powell's Hotel was owned by Major Powell of the Punjab Light Horse, when I was in India, and was established at Murree, the queen of hill stations. I knew Major Powell very well, and I never met a pleasanter or more loyal officer. He was exactly the sort of gentleman to represent England anywhere.

My first charge was the 81st Royal North Lancashire Fusiliers, and having called on the Mess and made the acquaintance of the officers, I soon made friends. A small bungalow in the lines was given to me. It was hot and very uncomfortable, but we were just as well off as anyone else, so were happy. Sawyer, later a Surgeon General, was in charge of the battery, and Sherman Bigg was Staff Surgeon to the G.O.C.

Sir Herbert Macpherson, V.C., K.C.B., commanded; Colonel Brine was C.R.E.; and Colonel Stokes, C.R.A. The troops were 7th Bengal Cavalry, Colonel Kauntz; 27th N.I., Colonel Hudson, afterwards Sir John Hudson, who was killed by a fall from his horse when commanding the Bombay Army. The Hudsons were very popular with us all and gave very pleasant garden parties. The 27th N.I. has another title now, but was a charming corps.

There is a very fine and popular club in Allahabad, known to-day as the N.W.P. and Oude Club, and a frequent residence of mine during my service, where I met many celebrated people and made many good friends.

The days were cool and pleasant, but followed each other rather monotonously, so we could form no idea of the heat which would soon follow. We began the day about 6 a.m. with *chota hazri*, and at 9 a.m. took breakfast and went to the hospital. After 12 o'clock we were free, except for two days in the week, when the turn of orderly medical officer came round. Tennis and games of all kinds filled up the afternoon, and then we foregathered at the club for an hour or so.

I had not achieved anything as a soldier yet, and must have been a fairly uninteresting military specimen at the time, but my first lesson was close at hand, although I was quite unaware of it. In these times Boards were held at the Liquor Go-down to test the beer about to be issued to the troops, and I was detailed for one. It so happened that I was purchasing a pony the same afternoon and did not put in an appearance, as I thought the Board knew the taste of beer as well as I did. The enormity of my crime—everything is a crime in the Army—did not stagger me in the least, but the "staggers" came later. Nothing occurred for two or three days, when one afternoon a mounted sowar rode to my house with a written note to present myself at the G.O.C.'s residence at once. I then hardly realized what I was in for, and gaily complied. When I reached the office I was met by the A.D.C., Hugh Childers, who immediately led me to the General. I walked in and saluted Sir Herbert Macpherson.

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Sir Herbert was a short, stocky and very powerful man, with a fine expression, high-coloured, and rather quick and abrupt in his conversation. He looked at me and said, "I wish to know why you were absent from the Board I ordered at the Liquor Go-down." I replied, "I forgot all about it, Sir." "Don't believe a word of it; you did not forget it." I was



Major-General Sir Herbert Macpherson, V.C., K.C.B.

silent. He then proceeded, "Look here young fellow, if you are going to start your career by telling a pack of d——d lies, the sooner you pack up and clear home the better." I murmured that I did not wish to tell any lies or deceive him, but merely tried to excuse myself. "Well, what is the

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truth?" In reply to this I admitted that I had purposely missed the Board, and gone off on my own private business. Sir Herbert then gave me a good dressing down, but towards the end he became kinder, and his last words were, "I hope I've impressed you sufficiently, and you will never fail to obey orders when you get them in future," and then, "Now go to Lady Macpherson and get some tea," and Childers, catching me outside, said, "General gave you some snuff, but it is all right or you wouldn't have got any tea." This was my first and last slating in the Army for such a cause as "telling packs of lies." Dear old General, I came to love him, and I was never so happy as when I had pleased him. He noticed some of my work in trying to prevent disease, and as a result became very kind to me. No one was smarter in dress, no one was more sensible in heat. He always wore an enormous topee, mushroom-shaped, and opened the upper buttons of his tunic. He once said to me, pointing to his headgear, "I don't funk the sun, Morris, but I have a great respect for him." He was greatly interested in fodder supply, and started "siloing" the grass through the cantonment; in fact, his recreation seemed to be hay farming. Something went wrong in the process, and when some of the silos were opened there was the most appalling smell in the station. A local scribbler issued an advertisement sheet, called "The Trades Circular," and wrote a leader for it every week. This person was put out by the smell of the silo, and wrote a ferocious article on it under the heading of "General Stinks," attributing the deaths of two people to this cause.

The Adjutant-General was Colonel Power Palmer, afterwards Sir Power Palmer, Commander-in-Chief. He was a very pleasant man, tall and handsome, and a most capable officer. He and Sir William Lockhart, later Commander-in-Chief, and a Colonel Fitzgerald, also handsome and agreeable men above the average, were known as the "Three Musketeers." I was brought much into contact with Sir Power, professionally and officially, while I was Staff Surgeon to Sir William Lockhart a few years later.

The principal Medical Officer was Deputy-Surgeon-General J. Hendley, C.B. His charming wife and he showed us always the greatest kindness, and we were constantly at their house. My immediate chief was Surgeon-Major J. H. P. Boileau; he and his wife were our very dear friends. He was a most able and scientific officer, but I may add without any idea of detraction, that he had several bees in his professional bonnet, and was a martyr to statistics.

The first bee was absolute scepticism as to the value of mercury in treating certain diseases of the soldier. The second bee was a dread of the use of a silver catheter and an exaggerated terror of the damage it could do. The third was that the temperature of the human was a degree higher in the tropics than elsewhere. In addition, he kept a complete record of the senior officers of the Corps, and from it compiled some remarkable results, on which he was often seriously consulted by senior officers

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anxious to know their chances of promotion. I need hardly add that it was his recreation and a pure work of love, quite appropriate to his gifted mind. He was much loved by all who served under him at Allahabad.

On one occasion I returned from Dinapore where I was stationed, and had met Major Charles Boileau and his charming wife. She was very beautiful, and by her kindness and interest in us became a shrine at which we all worshipped. She was known in an amiable sense as the Destroying Angel.

On my arrival for two days' leave at Allahabad I called on my old chief, and he at once insisted on my joining a dinner party that evening, which I heartily accepted. I turned up punctually and was ushered in by Judy. Judy was the name selected as appropriate to a hybrid Hindoo and Musulman, sanctified as a Mehter, and practising as Bearer. During dinner I watched every move in the interest of my host so as to be able to fill up a gap in the conversation, and omit nothing I could add to make the party a success. Suddenly a silence befell us and, like Horatius, in I plunged and bleated out, "I met your cousin, Sir, the fallen angel." "My cousin, the fallen angel, Morris; who can that be?" He then asked his wife, "Have I a cousin, the fallen angel?" In the meantime I was violently kicked under the table, and another fellow contorted his mouth and signalled, without emitting a sound, "Destroying angel." I read it slowly, and then my mistake dawned on me, and I at once said, "I beg your pardon, sir, I should have said 'destroying angel,'" and felt very uncomfortable. Everyone seemed relieved when the genial Chief said, "That's better, Morris, pass the port."

Sir Douglas Straight was a High Court Judge at Allahabad, and lived with his delightful wife in a large house in cantonments. We were frequently asked to tennis and dinners, and I think Lady Straight, who had lived in Russia, was the first lady I saw smoking a cigarette. She did it so nicely and so well, that it appeared quite natural, but she did not escape the venom of the station cats. Sir Robert Stewart was Chief Justice, and a year after our arrival was succeeded by Sir Douglas. The third judge was Mr. Justice Oldfield, who lived near the Straights with his wife and daughter, who afterwards married the Brigade Major, P. D. Jeffreys.

Mr. Oldfield had been through the Mutiny, and was credited with having been wounded in the chest and carrying a bullet in his lung. Another judge, Mr. Brodhurst, who lived in civil lines with his wife and charming daughters, dispensed great kindness and hospitality. I recollect in the summer of 1884 I procured the loan of a set of tandem harness, and exercised my skill with my ponies on the roads. Sometimes we would bowl along in good style with a chestnut mare I had bought from Russell of the Artillery in the lead, and a steady animal under my nose, but sometimes the unexpected occurred. One afternoon I was to play tennis at the Brodhursts, and I gave "Jellaby" Mansel of the 68th D.L.I. a lift, and all

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went well till I turned into the Judge's compound and was driving to the entrance. Suddenly and without warning the chestnut jibbed on to the tennis lawn, and efforts to get off seemed to entangle me more, till a lot of syces and friends bodily removed us from the scene to a safer place. Mrs. Brodhurst and her friends were watching my antics with displeasure, and I felt much ashamed. Luckily the ground was hard and very little damage was done, but it promised badly at the time. I was soon forgiven, and had to undergo some chaff. I remember the Misses Brodhurst, especially one who married "Polly," Lieutenant Pollard, then of the 7th B.C. and afterwards Colonel of the 15th Multanis. He was a dear friend of mine through all my service, but has gone with so many others. His wife and children were all lost in the "Roumanina," together with the Boutflowers of Allahabad. "Polly" had greatly distinguished himself in Burma, and was A.D.C. to Lord Roberts, Commander-in-Chief. "Polly" had one of the most charming natures, for he was loved by everyone and he was also one of the smartest soldiers in India I have ever met,. The Brodhursts were a great acquisition to our society, but the Judge himself, a particularly sound lawyer, was very quiet. They used to say that he either concurred or did not concur in a judgment, but whichever he did was usually right.

Not far from the Brodhursts lived Mr. Alexander Lawrence, the Commissioner of Allahabad. He belonged to the family of the great Indian Lawrences. We frequently played tennis there and dined, and at times he would put himself out to give young people pleasure. It was about this time that I was sent into a cholera camp and commenced to use the rifle. I stalked black buck, and I sent Mr. Lawrence almost daily a fine haunch of venison, and received on each occasion a short note of thanks. Now Shurajpore was forty miles from Allahabad, and it was the hottest time of the year, and no meat would keep fresh even over a short distance, but that little fact did not occur to me, till one day an Assistant Commissioner came to our camp and was talking to the Colonel. I overheard him say, "Is it one of your officers who is bombarding the Commissioner with venison which always arrives black and covered with flies? It is quietly sent away, but I really think he should be told of the state his shooting arrives in, for he will kill the Commissioner."

"Kill the Commissioner," thought I to myself. "I kill Mr. Lawrence." I went boldly up and confessed that I was the culprit who shot the buck, but I had never anticipated such a horrible result, and I was greatly disappointed and begged it might be explained. The Officer said, "I will speak to the Chief, but don't send any more venison up." The expression on his face showed me that he meant all he said. But I could not rest, and that evening I wrote expressing my sorrow for having inadvertently sent him my "shoot" in such a state, and I received a charming letter, telling me how greatly he appreciated my kind thought, and was glad that Mr. C—— had explained everything, and finished up by confessing himself. when he arrived in India first, as uninstructed as I was.

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The heat was very great but we "stuck it." We made also another dear friend in Geoffrey Hall and his wife. Geoffrey Hall was the Medical Officer of Naini Gaol. I first met Hall at a meeting of the Allahabad Branch of the British Medical Association, in the house of Dr. Smith of the Indian Medical Service. This was the period when medical men who counted at all did not require any military stiffening if they had acquired the amount of instruction in drill usually prescribed in any ordinary academy. It is true, though, that in my case I went further than that as a medical student, for one summer I was a member of the Victoria Rifles, and I attended one drill and about nine regimental band evenings. However, the spirit was there, though not evident in the drill.

Dr. Smith, with the relative rank of a Lieutenant-Colonel, was the Civil Surgeon of Allahabad, then one of the finest appointments in India. Smith was a true specimen of the old type, very conservative, very well informed, and a mighty shikari. It was with him that I saw my first and only tiger. He took me out to the Manickpur Jungle, and we spent a long time waiting in a *machaun*, a platform built in a tree, from about 10 p.m. to 1 or 2 a.m., but nothing disturbed us, and getting weary we slept on where we were till the morning, and then went to a small hut where the servants had everything ready for breakfast. Smith left me and rode over to visit a dispensary, returning at tea-time. During his absence I had my first square look at the Indian jungle. It was nothing approaching what I imagined. I saw large trees and small ones, green grass and burnt grass, beautiful parrots and orioles, while doves mourned on through the whole day. Close by was a large tank, and I sat and smoked and marvelled. This place was full of cats and deer and smaller game, but I did not see any, and I had been warned by Smith not to start shooting on my own account till I knew something about it.

He returned about 4 o'clock and we had tea, after which camp was struck and dinner ordered to be ready at Manickpur an hour before the mail arrived from Bombay. Keeping a horse each, and an attendant and two guns, Smith showed me how to shoot, and we got a small bag of odds and ends, and I was fairly successful with pigeons, as I knew how to deal with them. I saw the green pigeon or "haryal" for the first time, and often since then have breakfasted very well off this tasty bird. At about 8 the sun disappeared and a beautiful moon rose into the sky, bathing the jungle in a silver mantle. It was very light, and it was possible to see clearly a long way. We were walking down a slight grassy incline towards the station, and were passing a coriander bush, when suddenly a large animal bounded away from the side of the bush, and with a "Whoop, whoop, whoop," leaped two or three times down the hill and disappeared. "By gad," said Smith, "that was a tiger," and turning, asked the shikari "*Bagh hai?*" and the answer came, "*Beshuck, Garib parwar. Bara bagh tha.*" "Without a doubt a tiger, and a big one, oh feeder of the poor." Of course, nothing could be done then, so we passed on to the station and

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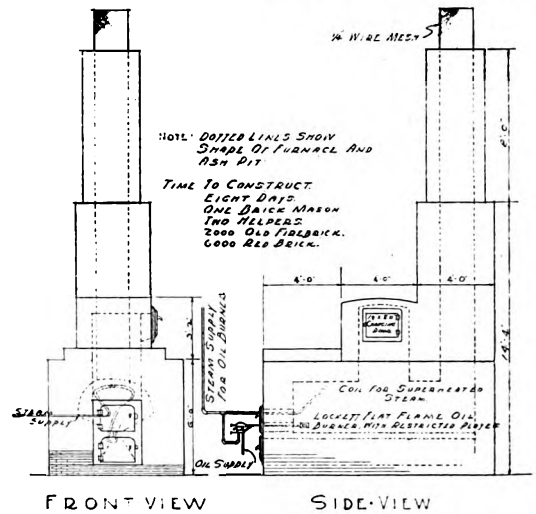
found a nice dinner arranged on the platform by our servants who were waiting to serve us. Afterwards we sat in chairs till we heard the mail winding its way through the jungle. Joining it, we reached Allahabad three hours later. Not long afterwards I was driving past Dr. Smith's house in the early morning, when I saw him in his compound talking to some natives, and I hailed him, and he hailed me in return. I did not notice anything different about him. However, when I returned to my bungalow, where Murray Irwin and I lived, he inquired, "How is old Smith?" and I replied, "Perfectly well; I saw him this morning and we hailed each other." "Well," said Irwin, "that is remarkable, for I have been told that he is very ill and not likely to live." Very soon after this Deakin, the Assistant Surgeon, wrote and asked me to go and see Smith with him, as he was ill and felt anxious. Away I went and found the dear old chap in a state of renal coma. He was a great loss to us. The funeral took place the following day and was a sad function. Later we erected a stone to his memory, and on this there was a very good portrait of him and secured in such a manner that it would be preserved. I saw it last in 1912, twenty-nine years later, and it made a weird and uncanny impression on me. I do not think I liked the idea.

(*To be continued.*)

Current Literature.

WESCOTT, O. D. **The Disposal of Hospital Refuse and Waste.** *U.S. Veterans' Bureau M. Bull.* 1929, v. 5, 777-81, 1 fig. & 1 pl.

Salvageable refuse from hospital comprises remnants of food from the kitchen and table, utilizable as food for domestic animals, and certain



Incinerator for disposal of tin cans, &c., at U.S. Veterans' Hospital, Legion, Texas.
[Reproduced from *United States Veterans' Bureau Medical Bulletin*].

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containers—wooden and tin boxes, oak barrels, canvas and sacks. Non-salvageable waste comprises personal refuse from the wards, e.g., newspapers, also cartons, light weight barrels, crates and many of the tins. To dump tins is unsightly; it encourages mosquito breeding and attracts insects; baling is expensive. At the U.S. Veterans' Hospital, Legion, Texas, a brick incinerator has been built lined with firebrick (see fig.) in which an intense heat (2,700° C.) is produced by using an oil furnace flat flame burner, superheated steam being brought into contact with the oil flame. Tins, cans and non-salvageable glass bottles are stored in barrels: these with the other refuse are burnt once a week in the furnace: 320 lb. of tins can be burnt in an hour, the oil used costing 80 cents. The refuse slag makes excellent road material. C. W. HUTT.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 7.

SURVEYOR. 1929, v. 76, 323-5, 7 figs. **Hull's New Refuse Disposal Works.**

Hull has installed at a cost of £30,000 a Heenan and Froude refuse disposal plant capable of dealing with 120 tons of domestic and trade refuse daily; for salvage an 8-hour shift suffices; two 8-hour shifts are required for incineration. Each load of refuse is weighed and classified; household refuse is tipped into the main reception hopper, the bottom of which consists of a slowly moving plate conveyor discharging on to a completely enclosed elevator. This, in turn, discharges into a circular horizontal screen where dust ($\frac{3}{8}$ in. mesh) and cinders ($1\frac{1}{2}$ in. mesh) are taken out. The dust is stored in a hopper for overhead discharge into road vehicles; the cinders are taken away by a belt conveyor to the cinder-cleaning plant or deflected for use, without screening, in the furnaces by a shoot on to a tailings conveyor. At the outlet of the screen, tins, etc., are extracted by an electro-magnetic separator of the horseshoe type; they pass by a shoot to the room beneath to be baled by a motor-driven press. From the belt conveyor which receives the tailings, salvageable articles are picked by hand; rags, bottles, etc., are collected in baskets and stored in bins; paper is placed in a bin and discharged to a motor-driven paper press in the room beneath. The remainder is widely distributed by a rotating discharge shoot on to the top feeding floor of the furnaces for incineration. Emergency tipping is provided in the event of breakdown of the salvage plant and also to permit of direct incineration of market and other non-salvageable refuse.

The destructor consists of one unit of five cells, each with its independent ashpit with controlled air supply. The "flat" grates are continuous. Refuse is hand-fed through circular openings in the main arch; each cell has its separate firebrick-lined door in the top feeding floor. The clinker is removed by hand through large door openings at the front, and is conveyed to the storage yard by steel skips suspended from an overhead track. The gases formed are mixed and burnt in a large combustion

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chamber (used also for the burning of bulky articles) before passing to the boilers. The tailings provide fuel for two Babcock and Wilcox boilers; when the tailings are exhausted steam is supplied by two auxiliary "turbine" boilers heated by the cleaned cinders. Electricity is generated for power used on the plant and for lighting the depot. Superheated steam is supplied to an adjacent works. The feed water for the boilers is softened by the lime-soda process.

A patent device (Heenan) is used for separating the cinders. To vary the size of the product one of the rolls of the two-roll type clinker crusher is made adjustable; the provision of coil springs allows foreign materials to pass through without injury to the rolls. Clinker mortar is made by a mortar mill.

C. W. Hutt.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 7.

Reviews.

The Diagnosis and Treatment of Heart Disease. By E. M. Brockbank. London: H. K. Lewis and Co., Ltd., 1930. Pp. xvi + 240. 35 illustrations. Price 7s. 6d.

The latest edition of this now well-known book has been brought up to date, and additional chapters dealing with aneurysm and angina pectoris have been added. The author deals fully with the important subject of systematic examination of the whole cardio-vascular system.

The chapters on the causation and interpretation of abnormal cardiac sounds are well and clearly written, and there is a good summary of the clinical signs of heart disease met with in everyday practice.

One wishes the author had given more space to the section on disorderly action of the heart and the clinical significance of its different forms.

The volume can be recommended not only to students but as a handy reference book to practitioners of all ages.

Diathermy, Medical and Surgical, in Oto-Laryngology. By Dan McKenzie, M.D., F.R.C.S.E. London: Kegan Paul, Trench, Trübner and Co., Ltd. Pp. xiv + 184. Price 10s. 6d.

This is a concise and entertaining exposition of modern knowledge and practice of diathermy in ear, nose, and throat work.

The arguments for and against diathermy are refreshingly honest and free from the bias which so frequently accompanies over-enthusiasm.

The author's experiences with medical diathermy are very instructive, and his claims of its benefit in such varied complaints as tinnitus aurium, ozœna, and otosclerosis appear reasonable, as he does not recite spectacular cures in every case. His results, using medical diathermy for obstructive

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catarrhal deafness of short duration, and for tinnitus aurium, appear to have been very gratifying. He stresses the fact that diathermy has proved of most service in the early cases of middle-ear deafness.

The chapter on surgical diathermy is a clear account of technique, with practical advice and reasoned deductions. The advantages he summarizes as: (1) relatively bloodless field of operation; (2) freedom from local and general reaction in lessened shock; (3) in malignant cases, reduced risk of scattering living cancer cells; (4) an inconspicuous scar.

The second half of the book deals with cancer, and the results obtained appear to have been excellent.

The description of a typical operation—removal of an epithelioma of the tonsil and glands of neck, using the diathermy flame as a scalpel—is lucid and extremely interesting, the lessened degree of pain and sepsis following this method being duly stressed. He deals firstly with eradicable cancers and later with ineradicable growths, but in referring to the tongue he might have informed the reader of the brilliant results achieved with radium in this organ.

Altogether this book is to be highly recommended, as in 177 pages of extremely interesting reading, the author summarizes his own extensive experience with diathermy, medical and surgical, in oto-laryngology.

C. H. C. B.

SENSATION AND THE SENSORY PATHWAY. By John S. B. Stopford, M.D., F.R.S. London: Longmans, Green and Co., Ltd. 1930. Pp. xii + 148. Price 7s. 6d.

No student of medicine who wishes to keep up to date can neglect the work of the modern anatomist. The author's contributions to the better understanding of the problem of sensation are well known and form the subject of this monograph.

Dr. Stopford is a supporter of Head's theory, and believes that the sensory side of the nervous system is fundamentally constituted by an affective system controlled by a phylogenetically younger discriminative one. Head's theory gains appreciably from Dr. Stopford's interest in it. Dr. Stopford's researches have laid a more exact anatomical foundation, and have also, among other things, led him to appreciate the manner in which the proper understanding of deep sensation supports the theory. The standpoint of the expert anatomist illumines the work and adds notably to its value and great interest, while on the pathological side many points of great importance to the physician and surgeon emerge.

Various theories which conflict with Head's theory are discussed, but they are found wanting. There is no doubt that a somewhat weak point in Head's theory has been the fact that, although the axons in a cut nerve trunk regenerate at practically the same pace, yet "epicritic" sensation returns much later than "protopathic" sensation, and may practically never return at all. This is a story which needs good telling, but Dr. Stopford's explanation is ingenious and soundly conceived.

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A bibliography is conveniently appended to each chapter. The book is excellently printed and got up, and is illustrated by diagrams and also by photographs of sections of brain-stem which are well reproduced.

STRETCHERS : The Story of a Hospital on the Western Front. By Frederick A. Pottle. Oxford University Press. London: Humphrey Milford. 1930.

The author explains in his introductory chapter that his purpose is, besides giving an account of the war service of Evacuation Hospital No. 8, to record the experiences of surgery by a layman. He gives a popular and most interesting record based on ideas obtained from conversation with surgeons and from reading.

The book deals with the history of a single unit in the non-combatant branch of the Service. Very full details are given of the unit from the earliest days, including all particulars of the recruit stage. There is a very good description of the pack, which the author considers was carried too high up and compared unfavourably with that used by the infantry. He is inclined to ridicule stretcher drill—"litter drill." He refers to barrack training as the happiest and healthiest time in the life of the soldier. Conditions later were too mournful.

Many interesting and amusing details are recorded of camp and barrack life.

The voyage to France was made under miserable conditions, and the food on the transport was reported as leaving much to be desired.

The volume includes a very interesting chapter on the history of the Collège de Juilly, which takes its name from the early Romans and was prominent in the 100 Years War. Joan of Arc is reported to have gained a victory in the vicinity.

The author pays a tribute to the work and technique of the famous surgeon, Dr. Harvey Cushing, in the treatment of head wounds.

Special attention is drawn to the method of keeping statistics by means of a duplicate field medical card. It is interesting to note that a similar method was devised by Major, now Colonel, L. W. Harrison at No. 2 British General Hospital in 1914.

Many specimen entries on the cards are given which are of great medical interest. The system of dealing with casualties was much the same as that used in the British Army and was obviously based on the earlier experiences of the war. It is interesting to note the complete adoption of the French word "débridement," which refers to the thorough cleansing of the wound with the removal of all dead tissue. No English term could have described it so neatly.

A graphic description of the Armistice and the resultant changes makes interesting reading.

The book concludes with a description of visits to Verdun, Mont Dore and finally to Germany, where the unit functioned prior to return to the United States.

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The author adds a chapter devoted to a short description of books, both lay and medical, bearing on the American Forces during the war.

The volume as a whole is well and graphically written and is composed from notes made at the time, which adds to the interest. While it will be most appreciated by members of the unit, there is much of general interest for those who wish to have a full description of work in a casualty clearing station or evacuation hospital. A. D. S.

Correspondence.

"THIRTEEN YEARS IN THE SUDAN."

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—In continuation of Captain Davidson's reply to "Benedict," published in your September issue, may I correct another "misapprehension"?

"Benedict" says that Kordofan Province marches with French Equatorial Africa. He must have overlooked Darfur Province (144,000 square miles) which lies between Kordofan and French territory.

Actually the distance by road from El Obeid to the frontier of French Equatorial Africa is 640 miles, and the shortest distance—as the "kite hawk" flies—between Kordofan and French territory is over 200 miles.

Khartoum,
Sudan,
September 22, 1930.

I am, etc.,
W. H. GILL,
Late Staff Serjt., R.A.M.C.

Notice.

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VOL. LV. DECEMBER, 1930. No. 6.

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Journal
of the
Royal Army Medical Corps.

Original Communications.

THE SEROLOGICAL DIFFERENTIATION OF THE FLEXNER GROUP OF BACILLI.

BY MAJOR R. F. BRIDGES,
Royal Army Medical Corps.

A NUMBER of papers have appeared in the Journal during recent years dealing with the types of Flexner bacilli isolated in cases of dysentery. The method adopted in the classification of these bacilli has generally involved the use of serums at full strength, which commonly vary in the case of each type, and the expression of results as percentages of homologous titres. That serum which agglutinates the organism to the highest percentage of its homologous titre is regarded as indicating the parent type of the bacilli.

There is no doubt that this method gives accurate results, though it appears somewhat clumsy in its working; and the use of strong serums, which require the setting up of two or more rows of tubes, is wasteful of both time and material.

The writer has consistently adopted a different method which he believes is simpler than that mentioned above; it is certainly more rapid in use, and with due care should give results which are no less accurate. The method depends upon the use of dilute serums which have been standardized to a definite titre, identical for each type, and a knowledge of the results which these serums will yield when titrated against the heterologous members of the group.

At the outset it is necessary to emphasize that all serums and emulsions used in the tests must be prepared only from colonies or cultures which

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are entirely "smooth" in character. Many difficulties and anomalies are likely to be encountered if attention is not paid to this fundamental precaution. Stock cultures of Flexner bacilli readily become rough when subcultured from month to month upon agar slopes, so much so that in a very short time three-quarters of the bacilli present in a culture may be found to have wholly or partially lost their smooth antigen, and to have acquired the rough antigen in its place. Emulsions prepared from such mixed cultures show delayed or incomplete agglutination, and their homologous serums give results from which incorrect conclusions may be drawn. For the rough elements present in the serums will cross-agglutinate with any rough elements present in heterologous types, and will even agglutinate so distantly related an organism as the *B. dysenteriæ* Sonne in its rough phase. The use of wholly rough cultures and serums has definite value for certain purposes, as has been shown by Bruce White [1], but in typing the bacilli of the Flexner group and other allied organisms, it is essential that the emulsions and serums used should be as smooth as it is possible to make them. Conclusions based on results obtained with impure and unselected materials must always be open to suspicion, for one cannot have variables on both sides of an equation.

To obtain a smooth emulsion it must be prepared from a selected colony; and it may be said at once that the mere appearance of a colony on a plate is no sure guide as to its character. The only true criterion as between smoothness and roughness is antigenic structure. The culture to be used is plated and carefully examined for smooth colonies. Half a dozen or more of those which have the smoothest appearance are picked into broth and on to agar slopes. On the following day the broth cultures are formalized and tested with known smooth and rough serums. The emulsion is then prepared from the agar slope corresponding to the selected colony. Only those colonies may be used which satisfy the following conditions:—

(1) They must be perfectly smooth in appearance on a plate.

(2) They must show even turbidity when grown in broth, without granularity, deposit or undue density.

(3) They must be rapidly and completely agglutinated by known smooth serums.

(4) They must show no trace of agglutination with known rough serums.

The emulsions to be used in the tests may be in the form of formalized broth cultures or of saline washings from agar slopes. Whatever method is adopted should be maintained throughout the tests.

The serums are prepared in the usual manner by injection of rabbits, using for the purpose the smooth type emulsions already prepared.

Having obtained the serums, they may be allowed to mature for a month or two, and should be tested for roughness, no trace of which should be present. They are then very carefully titrated against their homologous

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type emulsions, the end-point of the reactions being determined as closely as possible by the use of Dreyer's reduction table [2]. It is not sufficient to assess the titre at the exact value of the dilution in the tube itself. Both in the preliminary titrations and in the test proper the readings are taken after four hours' incubation at 53° C. in the water bath. Incubation for eight, sixteen or twenty-four hours has no advantage over four hours; if the foregoing directions have been followed the difference in titre, if any, is slight, and in any case has no significance in a standardized test.

The titres of the serums having been determined, a portion of each is diluted to such an extent that, when tested against its homologous type emulsion, it will show agglutination of the precise degree known as "standard"—neither more nor less—in a dilution of 1 in 250. Any subsequent adjustment of the titre, either upwards or downwards, which may be found necessary, can be effected by the method to be described later.

The standardized serums are then tested against their own type emulsions and also against those of the other four types. The results which may be expected are shown in the following table:—

Emulsions	Serums V	W	X	Y	Z
V	250	25	—	25	—
W	—	250	—	15	—
X	—	—	250	75	125
Y	125	250	175	250	50
Z	—	—	85	15	250

With the above table before one it becomes a simple matter to identify the type of any organism by the effect on it of the different serums. Types V and W can offer no difficulty at all; V is agglutinated to any significant titre only by V serum; similarly, W is only agglutinated by W serum. Types X and Z may possibly be mixed owing to the fact that X is agglutinated to 50 per cent of titre by Z serum, and Z is agglutinated to 35 per cent of titre by X serum. But in each case the height of the titres observed with X and Z serums will give the correct classification of the organism.

At first sight Y might be thought a difficult organism to identify owing to the fact that it is agglutinated to 100 per cent of titre by W serum, to 70 per cent by X serum, and to 50 per cent by V serum. On the other hand—and here is the saving clause—a Y serum does not agglutinate any type to anything approaching titre except itself. Hence if an organism agglutinates strongly with Y serum it must be a Y, notwithstanding the fact that it is also agglutinated by W and X and possibly by V.

The only further complication is in connection with the subtypes VZ and WX. Now in the strengths used in the test a V serum does not agglutinate Z; neither does a Z serum agglutinate V. Hence if an organism agglutinates with both V and Z serums it must be a VZ. Precisely the same argument applies to WX.

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Bearing the above points in mind the whole procedure may be reduced to a single tube test with each serum. The serums (titre 1 in 250) are diluted 1 in 60, so that 10 drops of serum plus 15 drops of emulsion gives a final dilution of 1 in 150. A single tube of each type serum is put up with the unknown organism in the above dilution. The reactions in the case of each type are as follows.

+++ = Total.
++ = Standard.
+ = Trace.

Organism under test	Serums V	W	X	Y	Z
V	+++	−	−	−	−
W	−	+++	−	−	−
X	−	−	+++	−	+
Y	+	+++	++	+++	−
Z	−	−	+	−	+++
VZ	++	−	−	−	++
WX	−	++	++	−	−

It may be advisable in the case of organisms which are inclined to inagglutinability to put up two tubes of each serum in 1 in 75 and 1 in 150 dilutions, obtained by taking 10 drops and 5 drops of serum diluted 1 in 30. If the reactions in the higher dilutions are indefinite they will show up well in the lower.

A criticism of this method may be that the serums must be continually losing titre, and that any reduction in their strength must completely upset results in a test which depends for its accuracy on the care with which the serums were initially standardized. The basis of this objection is no doubt sound, but it is contended that in practice it is of little account for the following reasons.

(1) With well-matured serums the loss is inappreciable in a month or even two months.

(2) When the titres do fall appreciably, the loss is synchronous in all the types, and may practically therefore be disregarded. It can be compensated by the use of slightly lower dilutions in the test.

(3) While the greatest degree of accuracy is always desirable, it is a fact that the reactions of each Flexner type differ so markedly that there is very good margin for error.

The time must come, however, when it will be found advisable to strengthen the serums to their initial titres of 1 in 250. This can be done by the help of the following simple formula. The number of cubic centimetres of strong serum which must be added to each cubic centimetre of weaker serum to bring the latter up to the required titre is equal to:—

$$\frac{a' - a}{b - a'}$$

where a is the present titre of the dilute serum; a' is the titre to which it is required to be raised; and b is the titre of the stronger serum which will be used for the purpose. Thus, supposing we have ten cubic centimetres

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of serum and we wish to raise its titre from 1 in 180 to 1 in 250 by the help of a serum having a titre of 1 in 2,200, then the number of cubic centimetres of strong serum which must be used for the purpose is equal to $\frac{250 - 180}{2{,}200 - 250} \times 10 = 0{\cdot}36$ cubic centimetre.

The formula can also be employed when it is necessary to reduce the titre of a serum either by dilution with saline, or with a weaker serum than that in use. In this case it must be remembered that the titre of saline is (or should be) 0, and that minus signs in both numerator and denominator cancel out one another. Hence the reduction in titre of one cubic centimetre of serum from 1 in 400 to 1 in 250 is effected by the addition of $\frac{250 - 400}{0 - 250}$ cubic centimetres of saline, which is equal to 0·6 cubic centimetre.

Summary.

(1) A test is described for the rapid identification of the classical strains of Flexner organisms.

(2) Some fallacies are suggested which may occur if unselected materials are used.

(3) A formula is given by which it is possible to convert the strength of a serum to any titre required.

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MILESTONES IN THE HISTORY OF INOCULATION.[1]

By Major H. N. STAFFORD, M.C.,
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1720. Smallpox inoculation introduced into England by Lady Mary Montagu.
1798. Introduction of vaccination by Edward Jenner.
1880. Pasteur immunizes against chicken cholera by attenuated culture.
1881. Introduction of the anthrax vaccine by Pasteur.
1885. Pasteur introduces protective inoculation against hydrophobia.
1888. Isolation of the toxin of diphtheria by Roux and Yersin.
1890. Discovery of the antitoxin of diphtheria by von Behring.
1897. Almroth Wright introduces preventive inoculation against typhoid by killed cultures.
1913. Introduction of the susceptibility test for diphtheria by Schick.

There must be few medical men who have not read or seen Mr. Bernard Shaw's admirable play, "The Doctor's Dilemma."

Those of you who are familiar with this work will, no doubt, recall that the play opens in the consulting room of Colenso Ridgeon, who has just been knighted for his discovery of a vaccine for the cure of tuberculosis. Among the doctors who come to congratulate him on his knighthood is an old cynic, Sir Patrick Cullen, who addresses Ridgeon in these words: "But your discovery's not new. It's only inoculation. My father practised inoculation until it was made criminal in eighteen-forty . . . I've tried these modern inoculations a bit myself. I've killed people with them; and I've cured people with them; but I gave them up, because I never could tell which I was going to do." Whatever we may think of Mr. Shaw's views, his accuracy in historical matters is beyond question, and he is perfectly correct when he tells us that inoculation is not new, and that it was made illegal in 1840.

Students of medical history cannot have failed to notice the curious fact that many so-called modern discoveries are but re-introductions of ancient customs. For example, inoculation for the prevention of disease, commonly regarded as a comparatively recent discovery, is in fact a very old one, practised—in the East at any rate—from time immemorial. This much is certain: but the period of its discovery and how it originated are purely matters for conjecture. There can be little doubt, however, that even in remote times it must have been recognized by man that certain diseases occur once only in the life of an individual, or that after recovery he is generally immune against further visitations of the same disease. It was also noticed probably that even a mild form of some maladies often

[1] A lecture delivered to the Officers of the Royal Army Medical Corps, Aldershot Command, at the Cambridge Hospital, Aldershot, February 17, 1930.

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confers protection against a recurrence of a similar infection. Thus we can assume that a vague appreciation of the principles of immunity existed at a very early period. From this knowledge it was but a short step to the artificial production of certain diseases by taking material from the sick and deliberately inoculating the healthy. Since those early times inoculation has become a more comprehensive process and includes, as you are well aware, the introduction into man and animals of many different substances, in many different ways, and for many different purposes. From old documentary records it appears that many primitive peoples used to protect themselves and their animals against various diseases in a crude kind of way, but with methods which are now recognized as essentially sound. Thus, certain tribes in South Africa attempted to render themselves immune against the bites of poisonous snakes by rubbing into the skin a mixture of snake venom and gum. The Moors immunized their cattle against pleuro-pneumonia by placing some virus of the disease under the skin of the animal. But of the many diseases which afflicted mankind there was none against which protection was more urgently needed than the smallpox. According to tradition smallpox had its origin in the Far East; but the evidence concerning its first appearance is scanty and unconvincing. It is certain, however, that smallpox was a familiar scourge in India and China long before the Christian era. Moreover, there are numerous accounts by various observers which show that there existed in early times in Eastern countries, as a means of protection against smallpox, the practice of inoculation or variolation. The process consists of introducing into the skin of a healthy person matter taken from a pustule of an active case of smallpox; the result is an attack of the disease, usually, though by no means invariably, mild.

Inoculation against smallpox is said to have been practised in India from a very remote period. It was performed by Brahmins who went on circuit at regular seasons for the purpose. Their method was to rub the skin of the part intended for inoculation with a cloth until small drops of blood appeared, and then to take a piece of wool charged with variolous matter, apply it to the wound and secure it with a bandage. In China, inoculation for smallpox was practised many centuries before it was known to the medical profession of Europe; the process was called "sowing the smallpox," and was carried out, either by plugging the nostrils with cotton saturated with an emulsion of smallpox scabs and water, or by grinding into a powder the crust from a pustule and blowing it into the nose through a bamboo pipe. Smallpox inoculation was also a well-known custom in Persia, Georgia, Armenia and Arabia. From Asia and Africa the practice passed into Europe by way of Greece to Constantinople, where it was known towards the end of the seventeenth century. In Western Europe inoculation was performed in certain districts of France, and was a well-known practice in Paris during the eighteenth century. It is interesting to note how a burning question of the day may be reflected even in the

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fashions of the times. Thus, the writer of the life of Mdlle. Rose Bertin, milliner to Marie Antoinette, relates how a method of dressing ladies' hair was introduced to coincide with the inoculation of the young King Louis XVI; this was known as the "Pouf à l'Inoculation," and every lady who wished to be in the fashion was obliged to adopt this coiffure.

It is difficult for the present generation to realize the prevalence of smallpox and its terrible consequences in the days of our forefathers. Some idea, however, of the ravages of this disease in Europe, prior to the introduction of vaccination, may be gathered from the estimates of the number of deaths from smallpox made by various writers.

Bernouilli, the celebrated mathematician, calculated that no fewer than 15,000,000 of human beings died of smallpox every twenty-five years. The French physician, De la Condamine, estimated that smallpox destroyed, maimed or disfigured a fourth part of mankind. In the words of Thebesius: "No nation, no rank, no constitution, neither age nor sex, escaped smallpox; all trembled in mentioning its name."

Macaulay portrays in striking language the horror with which smallpox was regarded in England at the end of the seventeenth century. In speaking of the death of Queen Mary II from smallpox, in 1694, he says: "That disease over which science has since achieved a succession of glorious and beneficial victories was then the most terrible of all the ministers of death. The havoc of the plague had been far more rapid; the plague had visited our shores only once or twice within living memory, and the smallpox was always present, filling the churchyards with corpses, tormenting with constant fears all whom it had not yet stricken, leaving on those whose lives it spared the hideous traces of its power, turning the babe into a changeling at which the mother shuddered, and making the eyes and the cheeks of the betrothed maiden objects of horror to the lover."

So prevalent was smallpox at this time that it was looked upon as practically unavoidable. Indeed, the difficulty of getting through life without it was expressed in a popular saying current in Germany during the eighteenth century: "*Von Pocken und Liebe bleiben nur wenige frei.*" (Few remain free from smallpox and love.) But although smallpox was regarded as an almost inevitable accident of human life, it was found by experience that nobody was attacked with the disease a second time. This immunity from a second attack seems to have been generally recognized and advantage taken therefrom, for people used to advertise for servants who had already suffered from smallpox, in much the same way as we advertise nowadays for dogs who have "got over" distemper. Here is an advertisement taken from a London newspaper of the period:—

"Wanted, a man between 20 and 30 years of age, to be a footman and under-butler in a great family; he must be of the Church of England and have had the smallpox in the natural way. Also, a woman, middle aged, to wait upon a young lady of great fashion and fortune; the woman must be

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of the Church of England and have had the smallpox in the natural way, very sober, steady and well-behaved, and understand dress, getting up lace and fine linen, and doing all things necessary for a young lady that goes in to all public places and keeps the best company. Enquire of the printer of this paper. October 1, 1774."

Such then, in brief, was the position as regards smallpox and its prevention up to the early part of the eighteenth century.

I have taken as my first milestone in the history of inoculation the year 1720, because the interest of medical science in the subject began about that time owing to the introduction of smallpox inoculation into England by Lady Mary Wortley Montagu. It appears that Lady Montagu, the wife of the British Ambassador at the Turkish Court in Constantinople, was much impressed by the harmlessness of the Turkish method of smallpox inoculation, and in 1717 wrote on the subject to a friend in England. An extract from her letter is worth quoting:—

"*Apropos* of distempers, I am going to tell you a thing that I am sure will make you wish yourself here. The smallpox, so fatal and so general among us, is here entirely harmless by the invention of ingrafting, which is the term they give it. There is a set of old women who make it their business to perform the operation every autumn in the month of September, when the great heat is abated. People send to one another to know if any of their family has a mind to have the smallpox. They make parties for this purpose, and when they are met (commonly fifteen or sixteen together) the old woman comes with a nutshell full of the matter of the best sort of smallpox and asks what veins you please to have opened. She immediately rips open that you offer to her with a large needle (which gives you no more pain than a common scratch) and puts into the vein as much venom as can lie upon the head of her needle, and after binds up the little wound with a hollow bit of shell; and in this manner opens four or five veins. . . . Every year thousands undergo this operation; and the French Ambassador says pleasantly that they take the smallpox here by way of diversion, as they take the water in other countries. There is no example of anyone who has died in it, and you may believe I am very well satisfied of the safety of the experiment, since I intend to try it on my dear little son. I am patriot enough to take pains to bring this useful invention into fashion in England."

Lady Mary was true to her word and had her son inoculated by Maitland, the surgeon to the British Embassy. Four years later the experiment was repeated on her baby daughter in England in the presence of several of the Court physicians. The event excited the greatest interest throughout the country, both in fashionable as well as in medical circles, but the British public regarded the practice with suspicion, and so for a time it made little progress.

In August, 1722, a suggestion was made to inoculate some condemned criminals at Newgate as test cases. Six criminals were, accordingly,

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inoculated under the direction of Sir Hans Sloane with satisfactory results. Indeed, the success of this experiment in some measure re-assured the minds of the people as to the safety of the practice. Towards the close of the year public attention was again drawn to the subject, by the announcement that the two daughters of the Princess of Wales had been inoculated. The practice thus encouraged by royal favour received a fresh impetus and began to spread throughout the country.

It was not long, however, before grave doubts as to the safety of inoculation arose by the announcement of several cases which had terminated fatally from smallpox after inoculation. Violent opposition to the practice sprang up both from members of the medical profession and the clergy, and a heated dispute rapidly developed. One doctor called inoculation "a barbarous and dangerous invention," another, "an artificial way of depopulating a country." A well known divine denounced inoculation in his pulpit as "a dangerous and sinful practice." Notwithstanding these outcries and many others of a similar kind, inoculation slowly gained ground in England, and in 1746 a hospital for the inoculation of the poor was established in London. However, as controversy still continued on the vexed question, the Royal College of Physicians decided in 1754 to issue a manifesto upholding the practice.

Inoculation reached America a few months after its introduction into England. George Washington and Benjamin Franklin were staunch advocates of the measure. Washington, in fact, had a general inoculation of all troops under his command, and gave orders that all recruits should undergo the same treatment.

In England, inoculation was not firmly established until more than a quarter of a century after its introduction. As time went on and inoculation continued to be practised, it gradually became evident that the benefits expected were far from being realized. For, not only did inoculation fail to exterminate smallpox, but actually spread it by keeping alive the natural disease and by causing its diffusion among those who were not protected by inoculation. In many instances smallpox was introduced by inoculation into towns which had previously been free from the disease. Moreover, as inoculated smallpox was just as contagious as true smallpox, and as few precautions against infection were taken, each case only served to disseminate the disease and smallpox continued to spread. There can be little doubt that inoculation protected those who submitted to it, by diminishing the chances of an attack of smallpox, and by lessening the virulence of the disease in those attacked; at the same time, it should be remembered that inoculated smallpox, although usually mild, was not always so, and many deaths occurred from the inoculated variety. Indeed, the Bills of Mortality clearly proved that in London more persons had died of smallpox since the introduction of inoculation into the country. In short: inoculation protected the individual, but endangered the community. Gradually the practice fell into disuse and

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disappeared some years after the advent of vaccination, smallpox inoculation finally being made illegal by the Act of Parliament in 1840.

The close of the eighteenth century saw the dawn of a new era in preventive medicine by the discovery and establishment of vaccination by Edward Jenner. He proved by his carefully-planned experiments that cowpox protects against smallpox, and to Jenner belongs the credit of giving to the world the priceless boon of vaccination. The protective value of cowpox against smallpox had been recognized by the cowherds and dairymaids of England as a vague tradition for some time—the milkmaids of Gloucestershire and elsewhere had found out this fact for themselves; but it was Jenner who by his insight and tireless labours translated a piece of folk-lore into a scientific truth, and persuaded the medical profession all over the world to accept it as such.

Jenner, at the age of 13, was apprenticed to a surgeon of Sodbury near Bristol, with whom he remained for six years. It was during this period of his life that the following incident occurred. A young woman came to seek medical advice, and the subject of smallpox being mentioned in her presence, she exclaimed, "I cannot take that disease, for I have had cowpox." Her remark, doubtless, made a deep impression on Jenner and suggested to him a new line of research. In 1770, when Jenner was 21, he went up to London to study under the great John Hunter, and there assisted him to form his museum. During his pupilage, Jenner told Hunter that he thought cowpox would prevent smallpox; but Hunter, apparently, was not much impressed with Jenner's idea. He did, however, give his pupil an excellent piece of advice, "Do not think," said Hunter, "but try, be patient, be accurate." There is no doubt that the influence of the master exerted a lasting effect on the pupil, who became an expert anatomist, a careful experimenter and a shrewd observer. Jenner soon got tired of life in London and returned to his native place—Berkeley in Gloucestershire, and there he lived, except for a short absence, a country doctor the rest of his days.

While at Berkeley he pursued his studies on cowpox by careful observation and experiment. Many years were to pass, however, before the crowning discovery of the prophylactic value of vaccination. At length an excellent opportunity occurred for making an important experiment. Cowpox broke out at a farm near Berkeley, and a dairymaid, Sarah Nelmes, contracted the disease from one of her master's cows. Jenner seized this opportunity and resolved to put his theories to a practical test. On May 14, 1796, Jenner took some cowpox matter from a pustule on the girl's hand and with it inoculated—or in other words, "vaccinated"—James Phipps, a healthy boy of 8 years. Six weeks later Jenner reinoculated the boy with variolous matter taken directly from a patient with smallpox, and much to Jenner's delight no small-pox followed. The continued absence of cowpox from the dairies in the neighbourhood prevented Jenner for some months from carrying out further experiments. However, when cowpox

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reappeared in the district two years later, Jenner repeated his first successful experiment on several occasions, and was thus able to demonstrate beyond doubt that cowpox, a mild and trivial disease, can be readily transferred from man to man, and, more important still, that it protects against smallpox. The chain of evidence was complete ; but Jenner proved his theory to his own satisfaction before making known the facts to the public. Writing of his discovery he says : " I placed it upon a rock, where I knew it would be immovable, before I invited the public to take a look at it." Hence, it was not until 1798, after twenty years or more of careful observation and research, that he published his now famous *Inquiry* announcing his discovery to the world.

The practice of vaccination thus introduced by Jenner was soon taken up in London and rapidly accepted both in Europe and America as a valuable protective measure against smallpox. It was adopted with enthusiasm in Switzerland, Italy and France. The Spanish Government fitted out an expedition in 1803 for the purpose of diffusing the knowledge of vaccination throughout all the Spanish possessions. The Empress of Russia, who was a staunch champion of Jenner, urged her subjects to be vaccinated and decreed that the first child vaccinated should be named " Vaccinoff " and be educated at the expense of the State. Jenner was a great favourite with Napoleon. The story is told of how Jenner petitioned the Emperor to allow two Englishmen detained in captivity abroad to return home. Napoleon was about to refuse the petition when he was reminded that it came from Jenner. "Ah, from Jenner ! " said the Emperor, " what that man asks is not be refused." And so the prisoners were released and sent back to England. Napoleon also demonstrated his confidence in Jenner's methods by ordering all soldiers, who had not suffered from smallpox, to be vaccinated.

It was hardly to be expected that so great an advance in preventive medicine could be made without opposition. The " Anti-vaccinationists " came into being shortly after vaccination was introduced. " Smallpox," they said, " is a visitation from God and originates in man ; but cowpox is produced by presumptuous impious men ; the former Heaven ordained, the latter is perhaps a daring and profane violation of our Holy Order." Tracts were published denouncing vaccination and sermons were preached to show the wickedness of the practice. Alarming stories of the evil effects of vaccination were noised abroad. One man declared that inoculation of the cowpox had been discontinued in the town in which he had been staying, because those who had been vaccinated " bellowed like bulls." It was also rumoured that women who had been vaccinated gave birth to children resembling calves. Another writer on the subject tells the story of a lady who complained that " since her daughter had been vaccinated she coughs like a cow, and has grown hairy over her body." Notwithstanding these fulminations, vaccination made steady progress throughout all classes of the population and every country vied in honouring its discoverer.

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A little more than one hundred and thirty years have passed since Jenner's epoch-making experiment in 1796. He believed that smallpox might be banished from the earth by the universal adoption of vaccination. His hopes have not been fully realized. Sound as Jenner's principles were, he fell into one error; he thought quite naturally, but wrongly, that one vaccination in childhood was sufficient to protect for life, and the discovery later that this was not so shook the faith of many in his methods. Nevertheless, Jenner's discovery, despite its many traducers, is a milestone of outstanding importance, not only in the history of inoculation, but also in the history of medicine itself. Since its introduction to the world in 1798, vaccination has made steady progress throughout all classes of the community, with the result of gradually diminishing the frequency of smallpox epidemics, the severity of the disease, its incidence on the population, and its death-rate. The principles which Jenner advocated and put into practice still remain the only effective means of protection against one of the most dreaded scourges that afflict mankind, and Edward Jenner will ever be remembered as one of the greatest benefactors of humanity.

Many years elapsed before Jenner's principles of vaccination were applied to other diseases. It is very largely to the brilliant researches of Louis Pasteur, and his investigations into the causation and prevention of disease, that we owe the foundation of the scientific era of inoculation which has produced such remarkable developments in recent times.

Pasteur's early work on fermentation and putrefaction led him to believe that infectious diseases were due to micro-organisms. While studying the disease chicken cholera, Pasteur made by chance a remarkable discovery—the only accidental discovery of his memorable career, but one which was to have far-reaching effects in the future. Pasteur discovered that micro-organisms could be modified in virulence. One day it happened that Pasteur inoculated some hens with an old culture of chicken cholera made some weeks before in his laboratory. Much to his surprise, the hens did not die; they sickened for a few days and then recovered. Clearly the virulence of the bacilli had disappeared. Some time later Pasteur reinoculated these same hens with a virulent culture, only to find that they remained well, while inoculation with the same culture was fatal to other healthy hens. Evidently Pasteur had lighted upon a method of producing immunity. With characteristic energy he set himself the task of finding out what had lessened the virulence of the bacilli in his old culture. After weeks of patient labour he proved that, by keeping cultures of chicken cholera a certain length of time in contact with the air, their virulence could be so diminished or attenuated as to be no longer capable of producing the disease. Furthermore, Pasteur discovered that, if hens were inoculated with the attenuated culture, they would become immune to infection with the normally virulent bacilli. Pasteur's discovery in 1880 of a method of producing immunity against

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chicken cholera by means of an attenuated culture is an important milestone in the history of inoculation—it might almost be called a foundation stone, for upon it was established the principle of bacterial vaccination—a principle which paved the way for the use of vaccines in many other diseases.

The experiments on the use of vaccines for chicken cholera formed the basis of Pasteur's investigations on anthrax or "charbon," the mysterious disease which was at that time causing such destruction among the cattle of France. The anthrax bacillus, discovered by Davaine in 1860, had already been isolated and identified in its various stages by Robert Koch. Pasteur's first attempts to produce a protective vaccine met with failure; but after numerous trials he was able to announce in February, 1881, that by cultivating the anthrax bacillus at an abnormal temperature (41° C.), he could obtain an attenuated form, which when introduced into cattle and sheep rendered them proof against anthrax. At first Pasteur's discovery was greeted with scepticism, and he was challenged by the Melun Agricultural Society to a public demonstration of his claim. Pasteur accepted the challenge and fifty healthy sheep were placed at his disposal; he was to vaccinate twenty-five of them, the remainder were to be used as controls, and later all fifty were to be inoculated with virulent anthrax bacilli. "You will see," wrote Pasteur with confidence, "the twenty-five unvaccinated sheep will perish, and the twenty-five vaccinated ones will survive." A further milestone was set up, which marks an occasion famous in the history of medicine, when in the spring of 1881, in a farmyard at Pouilly-le-Fort, before a large gathering of doctors, veterinary surgeons and farmers, the final test experiment was carried out, and, as Pasteur had predicted, the twenty-five vaccinated sheep remained well, while every one of the unvaccinated sheep died. It was, indeed, a great triumph for Pasteur. The success of this experiment led to the use of preventive inoculation against anthrax, now practised in all parts of the world where the disease is prevalent. It is interesting to note that Pasteur gave the name "vaccination" to his methods of protective inoculation as a compliment to Jenner.

Before, however, the completion of the discovery of the anthrax vaccine, Pasteur had embarked on a series of investigations of still greater importance, namely, those into the cause and prevention of rabies in dogs and hydrophobia in man.

In studying rabies, Pasteur concluded that the seat of the rabid virus was not in the saliva only, as it was previously thought to be, but was also in the cerebral tissues. His next step was to attenuate the virus for use as a preventive against the infection in dogs. This he succeeded in doing by drying in air the spinal cords of rabbits artificially infected with rabies. Furthermore, he found that dogs, inoculated in ascending doses with preparations of these dried cords, were immune to rabies when subsequently bitten by rabid animals. Pasteur, however, wished to go

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further. His next experiments were carried out to see whether inoculation with the attenuated virus would have a curative effect on animals already bitten; for he considered that, if this could be proved, it might then be possible to apply his treatment to human beings.

His hopes were expressed in a letter written to a friend in March, 1885, which runs as follows :—

"I also have some new experiments on rabies in hand, which will take some months. I am demonstrating this year that dogs can be vaccinated or made refractory to rabies after they have been bitten by mad dogs. I have not yet dared to treat human beings after bites from rabid dogs, but the time is not far off, and I am much inclined to begin by myself, inoculating myself with rabies, and then arresting the consequences; for I am beginning to feel very sure of my results."

As it happened the time was near at hand for trying his treatment on a human being, for, some months after this letter was written, a little Alsatian boy, who had been severely bitten two days previously by a mad dog, was brought to Pasteur's laboratory by his mother. Pasteur was persuaded to try his vaccine on the boy, and so give him the only apparent chance of recovery. A series of inoculations was therefore carried out over a period of thirteen days with no ill-effects. During the next few weeks, Pasteur became a prey to anxiety and dreaded to hear any moment that the boy had developed hydrophobia. The daily reports, however, were all favourable and the boy remained well. It was in October, 1885, that Pasteur made his statement on this case before the *Académie des Sciences*. By this time, three months and three days had passed and the boy had remained free from the disease. Directly Pasteur's great discovery was made known, people, who had been bitten by mad dogs, hastened to Paris from all parts of Europe, and a regular anti-rabic service was rapidly organized. Pasteur became immensely popular, and a subscription list was opened to the people of France for the establishment in Paris of an institute to bear his name. Thus was founded the *Institut Pasteur*. The example set in Paris was soon followed by other countries, and by 1889 there had been established at least twenty anti-rabic institutes in other parts of the world. Pasteur's discovery was confirmed by a Commission appointed by the British Government in 1886 to verify the facts. After fourteen months spent in investigating his treatment, they reported as follows: "It may be considered as certain that Monsieur Pasteur has discovered a prophylactic method against hydrophobia which may be compared with that of vaccination against smallpox. It would be difficult to over-estimate the utility of his discovery, both from the point of view of its practical side and of its application to general pathology."

Enthusiasm for Pasteur was spreading everywhere, and he was inundated with letters suggesting that he should find cures for such and such a disease. One day he received these lines: "You have done all the good a man could do on earth. If you will, you can surely find a remedy

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for the horrible disease called diphtheria. Our children, to whom we teach your name as that of a great benefactor, will owe their lives to you.—A Mother."

Pasteur, in spite of his failing strength, had hopes that he would yet live to see a method of dealing with this disease devised. About this time Roux and Yersin, two pupils of Pasteur, were busily working at the Pasteur Institute to find a remedy for diphtheria. The bacillus, already discovered by Klebs in 1883, had been isolated in the following year by Löffler. Roux believed that the bacillus formed a toxin, and proclaimed his belief in a lecture delivered to the London Royal Society. "Microbes," declared Roux, "are chiefly dangerous on account of the toxic matters which they produce." Accordingly, Roux and Yersin set themselves to work out this problem, eventually in 1888 making the brilliant discovery that by filtering a broth-culture of diphtheria bacilli through unglazed porcelain they could obtain in the filtrate the toxin of the bacillus.

Before passing on to the next milestone, it is necessary to mention the theory of phagocytosis advanced by Metchnikoff a year before the discovery of the diphtheria toxin; for out of this famous theory arose the notion of making use of the serum of the blood as a therapeutic agent. It had been shown by bacteriologists that the serum of the blood plays an important part in resisting disease, and the idea of combating the toxins produced by pathogenic bacteria with resistant serum presented itself to several workers. This line of inquiry was followed up, and in 1890 came the classical discovery of the antitoxin of diphtheria by von Behring and the antitoxin of tetanus by Kitasato. These two workers proved that immunity against the toxins of diphtheria and tetanus could be obtained by the transference of the serum of animals previously immunized by a course of inoculation with such toxins—in short, that the serum of immunized animals is curative. Roux was mainly instrumental in bringing the subject from the experimental to the practical stage; for he discovered an easy method of making horses immune, and was thus able to obtain large quantities of antitoxin. Diphtheria antitoxin was placed in the hands of the medical profession in 1895—the year that Pasteur died. Since that date its value has been abundantly proved, not only as a curative agent for the protection of those suffering from diphtheria, but also as a prophylactic measure for those in contact with the infection.

The discovery of diphtheria antitoxin was a triumph of laboratory research and constitutes yet another milestone in the history of inoculation; for its introduction, together with that of the antitoxin of tetanus, into practical human therapeutics, laid the foundation of serum therapy.

It is impossible in the time available to consider the enormous developments of prophylaxis and treatment by specific inoculation since the new era of bacteriology was inaugurated by Pasteur, Koch and their immediate followers. It will be sufficient to say that our knowledge of this branch of preventive medicine has advanced along two distinct lines. On

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the one hand is the method directed to the active immunization of persons by means of the various forms of protective inoculation with suitable vaccines; on the other is the method directed to the passive protection of persons by the transference of the serum of animals actively immunized by inoculation against certain specific diseases.

I have taken the year 1897 as another important milestone, because the use of killed organisms as a prophylactic measure against disease dates from that time. To Almroth Wright must be given the credit of initiating and exploiting a method of protecting against typhoid fever by means of killed cultures of *B. typhosus*. Further, it is largely owing to the advocacy of Wright that killed cultures have come to occupy an important position in the prophylaxis and treatment of many infections which can be definitely associated with a known type of organism. Wright's anti-typhoid vaccine was first tried on a large scale at Barming's Heath Asylum in 1897. Two years later it was used in India, when 4,000 British soldiers were inoculated. Then came the South African War, during the course of which Wright and Leishman prepared a vaccine and supervised the inoculation of 100,000 soldiers. The results, however, were disappointing. Leishman explained the lack of success by saying that the vaccine may have been rendered less effective by the use of too great a heat in killing the bacilli; further, no account was taken of the paratyphoid fevers, against which inoculation with the single typhoid culture offered no protection. Nevertheless, it was clear that a new weapon of great prophylactic value had been placed in the hands of Army medical officers. The results obtained with the anti-typhoid vaccine, especially under war conditions, and notably during the Great War, have been extremely satisfactory, and prophylactic vaccination against the enteric group of fevers has now established its position in preventive medicine.

This brings me to my last milestone—the discovery of the susceptibility test for diphtheria by Schick of Vienna. It can be asserted confidently that this discovery ranks in importance almost with that of the discovery of the antitoxin; for what the use of the antitoxin has done to improve the treatment of the disease, this method of detecting susceptibility together with the immunisation of susceptibles is now doing for its prevention. The discovery of this simple test in 1913 was soon followed by an easy method of immunizing susceptible persons against diphtheria. Several types of preparations have been used for the purpose; but all have as their basis diphtheria toxin which has been modified, either by association with antitoxin, or by treatment with some chemical agent. The method of immunization thus rendered available has been employed for some years in New York and other towns of America, and the diminution of diphtheria has been truly remarkable in the American communities in which this method has been adopted. Since 1920, Schick testing and immunization have been practised in a number of residential institutions and schools

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throughout Great Britain with extremely favourable results. Although it is too early to dogmatize on this subject, the evidence which is steadily accumulating points to the conclusion that the Schick test together with the artificial immunization against diphtheria constitute one of the most notable of the recent advances in preventive medicine.

I have told you nothing original nor new. Indeed, it seems almost an impertinence to discourse before an audience of medical men, upon such well-known names as Jenner and Pasteur, and upon such familiar subjects as vaccination and inoculation.

This brief and imperfect outline of the history of inoculation makes no pretension to completeness; but from the "milestones" cited some measure, perhaps, of the debt we owe to these pioneers in preventive medicine may be gathered. Almroth Wright's prophecy that the physician of the future will be an immunizator has to a great extent been fulfilled. Numerous diseases have come under the immunizator's control; and yet we cannot forget that there are many, which yearly take a heavy toll of human life, against whose ravages he is at present powerless. I do not wish to conclude on too pessimistic a note, nor in any way minimize the great achievements of medical science; but one cannot help thinking that there is a good deal of truth in the words of a writer in a recent number of the ROYAL ARMY MEDICAL CORPS NEWS AND GAZETTE.

> "At last, through centuries of pain and cruelties that shocked her,
> Our Mother Earth achieved for us the Scientific Doctor.
> He knows the cause of all disease; our doubts he can dispel;
> Yet even now, as in the past—some die and some get well.
> There surely must be, you'll agree, some all pervading factor;
> For Doctor, Christian Scientist, Coué and Chiropractor,
> All seem to do their best or worst to cure this mortal shell;
> And always with the same result—some die and some get well."

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THE DYSENTERIES OF MHOW, CENTRAL INDIA AND THE CENTRAL PROVINCES.[1]

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This report deals with an investigation, lasting from January, 1926, to July, 1928, into the causation of the dysenteries of Mhow, Central India, and of some neighbouring military stations in the Central Provinces. The work was preliminary to an attempt to produce a vaccine against bacillary dysentery which could be administered in some manner other than by subcutaneous inoculation, and was financed by the Indian Research Fund Association.

Cunningham, Acton and Knowles, and others, have shown that the idea at one time firmly held in India that almost all dysentery in this country is caused by *Entamœba histolytica* is entirely incorrect. Manifold proved that amongst the military and civil population of Poona, the dysenteries are almost all caused by *B. dysenteriæ* Flexner and that a mild enteritis with dysenteric symptoms, known as "Poonaitis," is in fact bacillary dysentery.

Our own findings, so far as Mhow and neighbouring stations were concerned, confirm the above, for over ninety per cent of dysentery cases investigated were bacillary infections, by far the commonest organism present being *B. flexner*. The population from which the cases came was a military one, but, in order to ascertain if the same proportion held amongst civilians, we examined many stools from bazaar patients, and here again bacillary dysentery was far more commonly met with than amœbic.

Collection of Material.

Most of the material examined came from the local garrison. The Central Provinces District Laboratory in Mhow suffers from being situated one mile from the British and over two miles from the Indian Military Hospital. For some months, all stools were collected from both hospitals in the bedpan and sent by motor ambulance, and the percentage of positive findings was over ninety. Then economy produced a sweeper on a bicycle, with material in test tubes, and the road to the laboratory is uphill. Finally a sort of baker's hand-cart replaced the bicycle, with the advantage of being capable of carrying several bedpans, but with the drawback of

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being very slow indeed. And with each change the proportion of failures recorded became higher.

It is well known that the chances are small of finding a causative organism, whether bacillus or protozoon, in a stale stool. It was surprising to find that, once the stool was more than thirty minutes old, specimens one, two, and three hours after passage gave much the same proportion of positive results, and that it was only after three hours that the percentage again fell. The warmth and humidity of the air during the dysentery season, and the fact that material is usually sent for examination during the heat of the day, between 9 a.m. and 4 p.m., probably help the survival of dysentery bacilli in a mucous stool, and militate against it, by encouraging the growth of *B. coli*, in a fæcal one.

Table I shows the percentages of positive results (*B. flexner* or *B. shiga*) obtained from 150 consecutive cases showing a definite bacillary exudate, ranged according to age at the time of plating.

TABLE I.

Age when plated	Percentage of total	Positive results
Less than half hour	15·9	93·7
Half to one hour	25·4	67·7
One to two hours	25·2	78·9
Two to three hours	20·0	73·3
Over three hours	13·5	40·0

From out-stations dealing with the laboratory, the following specimens were sent from every case of clinical dysentery: mucus in Churman and Teague's glycerine solution for culture; smears of mucus on slides for identification of the cellular exudate; smears on coverslips fixed in Schaudinn's solution for examination for protozoa. Most of these stations, while no more than twelve to twenty-four hours distant by train, were from three to seven days away by registered parcel post.

The percentages of successful isolations from definite bacillary exudates from local and out-station cases were as under:—

In 1926	Local ..	71 per cent
	Out-stations	46 ,,
In 1927	Local ..	56 ,,
	Out-stations	43 ,,

THE PRELIMINARY DIAGNOSIS.

Our practice in reporting on cases was that of most laboratories nowadays, that is, a preliminary diagnosis was made from the microscopical nature of the cellular exudate, and this was sent to the hospital by the man who brought the stool, or telegraphed in the case of out-stations, the object being that appropriate treatment should be begun as early as possible.

We found, as have other workers, that Shiga infections were not necessarily severe, nor Flexner infections mild, and medical officers did not gain by knowing the identity of the causative organism in bacillary cases, if proteins were excluded from the diet until the Shiga infection had been

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excluded. The question of whether to administer anti-dysenteric serum was best decided on clinical grounds alone, and comparatively few cases required this treatment.

The Exudate.

During the two years under consideration the total numbers and the distribution of exudates, as classed by microscopical appearance, were as under:—

Year	Definite bacillary		Indefinite		Protozoal	
	Number	Per cent	Number	Per cent	Number	Per cent
1926	140	69·7	41	20·4	20	9·9
1927	124	69·7	43	24·2	11	6·1

Throughout the report percentages for 1926 and 1927 are given separately rather than the average for the two years, since where they remain much the same it may be taken that the figures represent fairly accurately the usual relative annual incidence.

The typical bacillary exudate is quite unmistakable under the microscope. It is worth recording that exactly the same exudate was seen in three cases of typhoid fever which ended fatally without perforation, and in no case which recovered. We saw this exudate also in two or three cases of cholera amongst Indians, but it may be that this was merely the waking up of a chronic bacillary dysentery by the new infection.

As a rule, one glance down the microscope is sufficient to recognize the definite exudate, but not infrequently, especially where the patient has not reported sick at the onset of the disease, or in chronic bacillary cases, search has to be made before a patch of pus cells, macrophages, and ghost cells is met in the mass of mucus studded with occasional red blood-cells.

An indefinite exudate, consisting largely of mucus, a few red cells, pus cells, cells from intestinal mucosa, and much cellular and unrecognizable granular debris, usually did not yield any causative organism, either bacillus or protozoon. Flexner bacilli were isolated sufficiently frequently from such exudates to bear out the opinion that they are probably more often than not an indication of subacute, or chronic bacillary infection. This supposition is supported by the fact that one may see this picture rarely preceding, and more often following, a definite bacillary exudate. During the two years the latter was met a day or two after the former in fourteen cases, from seven of which *B. flexner* was isolated and from one *B. shiga*.

Two adults and two children of one family, taken ill within forty-eight hours of each other, all showed indefinite exudates, and from three of these *B. morgan* was isolated, while the fourth gave a negative result.

Pieces of mucus adhering to the fæcal masses produced by an enema in a very constipated subject will often show the same elements as does the indefinite exudate, with the exception of the red blood-cells.

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In the absence of active pathogenic protozoa, there seems to be nothing one can call a definite protozoal exudate, but there are certain findings which encourage further search for amœbæ. The presence of a large number of eosinophiles, as pointed out by Anderson, is suggestive, as is agglutination of the red blood-cells, as contrasted with the free-floating red cells in a bacillary exudate, and this latter characteristic alone, in an otherwise definite bacillary exudate, was considered sufficient evidence on which to base a tentative diagnosis of "probable mixed infection."

Charcot-Leyden crystals were present in fifteen acute dysenteries, and were accompanied by *E. histolytica*, either in the first specimen examined or during the following few days, in five of the patients, while a sixth showed this amœba in a relapse six months later. *Trichomonas hominis* in unusually large numbers was the only finding in three more cases, in two of which an occasional protozoon contained a red blood corpuscle. All the above nine patients were adults. Of the remaining six, five were children of ages ranging from 8 months to 4 or 5 years, and in all these the exudate was definitely bacillary in character. No amœbæ were found in frequent examinations.

We never saw Charcot-Leyden crystals in a stool containing *E. histolytica* cysts or in the absence of mucus, and the conclusion suggested by these few cases is that their presence in an adult is very suspicious of active amœbic infection, but that in an infant they have not this significance. When they were met with in an adult, it seemed justifiable to recommend a full course of treatment for amœbic dysentery.

The diagnosis of amœbic dysentery was never made on the finding of *E. histolytica* cysts, as 10 to 15 per cent of Indians, and a doubtful proportion of Europeans, normally pass such cysts.

A not uncommon exudate amongst Indians was one definitely bacillary in character in cases which showed *E. histolytica* a day or so later. Of six mixed infections diagnosed microscopically and by culture, four began as definite bacillary cases, and the same sequence was seen in four out of eight amœbic dysenteries from which no pathogenic bacillus was isolated but which also were undoubtedly mixed infections. It seems quite clear that all these eight cases had a latent amœbiasis which was lit up by an acute bacillary infection without which the amœbæ would presumably have remained quiescent.

The reaction of the exudate in 204 consecutive local cases is shown in Table II. The term "protozoal exudate" is here used only of one containing *E. histolytica*.

TABLE II.

Exudate	No.	Percentage		
		Acid	Neutral	Alkaline
Bacillary ..	160 ..	2·5 ..	10·0 ..	87·5
Indefinite ..	32 ..	12·5 ..	50·0 ..	37·5
Protozoal ..	6 ..	10·0 ..	— ..	—
Mixed .	6 ..	66·6 ..	— ..	33·3

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Acidity in a bacillary dysentery stool could usually be accounted for by the presence of urine.

In one mixed *B. flexner* and *E. histolytica* infection, the exudate was alkaline on the first day of illness, indicating a bacillary infection, and acid on the following day, when amœba were found in the stools.

The reaction of the mucus can be tested by anyone with a book of litmus papers, and if, where facilities for microscopical and cultural examination are not available, dysentery cases with an acid reaction were treated as amœbic infections and all others as bacillary infections, the resulting errors of treatment would probably be fewer than at present.

Laboratory Methods.

Endo's medium was first used for plating, but was quickly abandoned in favour of litmus lactose agar, as giving better differentiation once reliable litmus, an absolute necessity, was obtained.

An attempt was made to follow up the microscopical diagnosis referred to with a final diagnosis twenty-four hours later, by emulsifying suspicious colonies directly from the plate in a drop each of Shiga and Flexner agglutinating sera. This proved useless, as many Flexner strains were inagglutinable, and several other organisms, notably *B. pyocyaneus*, were frequently agglutinated by low dilution Flexner serum.

Lactose, glucose, mannite and dulcite, phenol red milk, and peptone salt media were used for testing biochemical reactions. Many textbooks attribute to *B. flexner* and other dysentery organisms quite definite action on these media, and it was hoped by using them to make at least a preliminary grouping, but it was soon evident that this was not possible. It may be permissible to remark that writers of reports and textbooks frequently omit to state the number of days organisms are incubated before readings are made, knowledge necessary to those who wish to use their result or repeat their work.

Nearly all strains of *B. flexner* isolated failed to produce any change in phenol red milk after the first slight acidity resulting from twenty-four hours' incubation. Their action on sugar media could not be relied upon for identification, for many strains which were agglutinated by Flexner high titre serum gave varying degrees of acidity in lactose during the first seven days, and more rarely in dulcite.

Maltose, saccharose, dextrin, raffinose, arabinose, inulin, sorbite and galactose were later added to the sugars already in use, and the action on these of many strains isolated was tabled daily over a period of fourteen days' incubation. Their effect on maltose and saccharose gave no definite help in identification, while that on remaining sugars was so variable as to be useless as an aid to classification.

As a result of testing fifty-seven strains of *B. flexner* proved serologically, and watched in all the above media for fourteen days, this organism was

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defined for the purposes of this investigation as follows: A non-motile Gram-negative, non-sporing bacillus, producing acid without gas in glucose within twenty-four hours, a similar change in mannite which may sometimes be delayed for another twenty-four hours, and having as a rule no effect an either lactose or dulcite. Most strains produced indol.

Table III shows the reactions on all media used of four strains of *B. flexner* which were proved serologically, and demonstrates the unreliability of their classification by biochemical action only.

TABLE III.

Flexner strains	Day	Lactose	Glucose	Mannite	Dulcite	Maltose	Dextrin	Raffinose	Arabinose	Adonite	Inulin	Galactose	Saccharose	Milk	Indol, 2nd day
Shaw	1st	As	A	A	—	A	A	A	—	—	—	—	A	A	—
Smith, I	..	As	A	A	—	A	A	As	—	—	—	—	—	A	+
Washington	..	—	A	A	—	A	A	—	—	—	—	—	A	A	+
Jage Ram	..	—	A	A	—	A	A	—	—	—	—	—	A	A	+
Shaw	5th	A	A	A	—	A	A	A	—	—	—	—	A	A	..
Smith, I	..	As	A	A	A	A	A	—	—	—	—	—	—	A	..
Washington	..	As	A	A	—	A	—	A	—	—	—	—	A	A	..
Jage Ram	..	—	A	A	—	A	A	—	—	—	—	—	A	Alk	..
Shaw	14th	A	A	A	—	A	A	A	—	—	—	—	A	A	..
Smith, I	..	As	A	A	A	A	A	—	—	—	—	—	—	A	..
Washington	..	A	A	A	—	A	—	A	—	—	—	—	A	A	..
Jage Ram	..	—	A	A	—	A	A	—	—	—	—	—	A	Alk	..

A = Acid. As = Slight acidity.

DYSENTERIC AND OTHER ORGANISMS MET WITH.

During 1926, 140 cases of dysentery in the acute stage showed a typical bacillary exudate, while only fifteen cases of amœbic dysentery were diagnosed.

During 1927 the figures were 124 and 6 respectively.

The percentage representations are :—

Year	Bacillary	Amœbic
1926 ..	90·3 ..	9·7
1927 ..	95·4 ..	4·6

From many of the bacillary cases no possible causative organism was isolated. If, for purposes of comparison, only those cases are considered to be of bacillary origin from which either *B. shiga* or *B. flexner* was isolated, the percentages are :—

Year	Bacillary	Amœbic
1926 ..	85·8 ..	14·2
1927 ..	89·5 ..	10·5

There is no doubt then that bacillary dysentery is some nine times more common than amœbic in acute dysenteries in the area investigated.

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The organism most frequently isolated from bacillary infections was *B. flexner*. The percentage frequencies of this and of *B. shiga* were:—

Year	*B. flexner*	*B. shiga*
1926 ..	95·9 ..	4·1
1927 ..	94·1 ..	5·9

During the two years, from 264 cases showing definite bacillary exudates, either *B. flexner* or *B. shiga* was obtained from 124, or only 46·9 per cent. This is partly accounted for by the fact that a considerable number of specimens came through the post from stations several hundreds of miles away.

From purely local cases these organisms were isolated from seventy-one per cent during 1926, from 56 per cent during 1927, the fall being undoubtedly largely due to the change in methods of bringing stools to the laboratory.

An organism resembling *B. morgan* was obtained in the acute, subacute, and chronic stages, from numbers of cases, but often in conjunction with *B. flexner*. From acute stools it was isolated alone in 5 per cent of cases in 1926, in 11·3 per cent. in 1927. It was not agglutinated by the patient's serum in the seven cases in which this test was made.

As already related two adult and two infant members of one family were taken ill with mild dysenteric symptoms within forty-eight hours of each other. In all four the exudate was indefinite in character, and from three *B. morgan* alone was isolated, while no possibly pathogenic organism was grown from the fourth case.

B. dysenteriæ Schmitz, as classified serologically, though it could not always be induced to produce indol, was recovered alone from 7·1 per cent of acute cases in 1926, from 4 per cent in 1927. It was agglutinated in 1/250 dilution of the serum of one out of four cases tested.

An organism resembling biochemically the members of the Salmonella group, but not agglutinated by any of the sera of that group, was occasionally seen in acute and more often in subacute and chronic dysenteries. It was frequently isolated in conjunction with *B. flexner*, and we did not form the impression that it was a possible cause of dysentery. On the other hand this organism was rarely met with in several thousand investigations of the fæces of healthy followers, and never in any other disease than dysentery. It was distinguishable from the Salmonella group of organisms by the immediate and intense production of alkali in phenol red milk.

From two cases of typical acute bacillary dysentery occurring on the same day in the same unit, and with no symptoms of food poisoning other than are common to the two diseases, *B. aertrycke* Newport was isolated.

B. enteritidis Gaertner was the only organism obtained from the stool of a patient with the symptoms of chronic dysentery, but was not necessarily the causative organism.

B. asiaticus, agglutinated by a serum made against a strain of this organism supplied by the R.A.M. College, Millbank, was isolated during the acute stage on three occasions.

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B. dysenteriæ Sonne was in our experience very rare, as judged by serological tests, but several organisms which proved serologically to be strains of *B. flexner* gave the biochemical reactions of the former.

The importance of sending stools to the laboratory for culture as early as possible in the disease is shown in Table IV, which gives the percentage of isolations of either *B. flexner* or *B. shiga* from 222 consecutive cases diagnosed bacillary dysentery on the appearance of the exudate.

TABLE IV.

Day of disease on which first specimen was received	Number of cases	Percentage of cases from which *B. flexner* or *B. shiga* was isolated
1st	104 ..	67·3
2nd	50 ..	44·0
3rd	26 ..	47·7
4th	13 ..	46·2
5th	6 ..	50·0
6th	6 ..	33·3
7th	5 ..	40·0
After 7th ..	12 ..	8·3

Both local and out-station cases are included in the above.

It is obvious from this table that there is a much greater chance of isolating the infecting bacillus on the first day of disease than on any subsequent day.

During the two years, organisms in the following proportions were isolated from the stools of dysentery cases in Mhow and the surrounding stations. Only those organisms which were present alone are included; if one case produced, for instance, both Flexner and Morgan, the former alone is counted. It is not suggested that all are pathogenic:—

B. dysenteriæ Flexner	75·2 per cent.
B. dysenteriæ Shiga	3·8 ,, ,,
B. dysenteriæ Schmitz	9·5 ,, ,,
B. dysenteriæ Sonne	1·3 ,, ,,
B. aertrycke Newport	1·3 ,, ,,
B. enteritidis Gaertner	0·6 ,, ,,
B. morgan	7·0 ,, ,,
B. asiaticus	1·3 ,, ,,

PERSISTENCE OF ORGANISMS IN THE STOOLS.

For eighteen months out of the two years, no man left the hospital until his stools had given negative culture results for ten consecutive days. During this time we only recovered dysentery bacilli from one adult patient in the absence of visible mucus. This man had a persistent mild diarrhœa. The most careful examination, however, must be made before mucus is declared to be absent. On very many occasions, indeed, it was not seen until picked up by the copper wire spatula, and it is very doubtful whether it is safe to lay down that dysentery organisms are not being passed if "visible mucus" is absent, since this term may easily be misunderstood by those responsible for the examination. It was not uncommon for a report of "no mucus" to accompany a specimen, yet for this to be found

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in the laboratory, owing to the different methods of examination possible here and in the hospital.

During the remaining six months of the two years, patients were discharged from hospital when they had ceased to pass macroscopically visible mucus for ten days, each case being checked by two or three bacteriological examinations. The reason for this was that lactose-fermenting bacilli of various kinds are frequently present in healthy fæces in this country, and the time necessary for the identification of such organisms isolated on, say, the tenth day leads to an unnecessary delay in the discharge of the patient.

As already stated, from one single *adult* case in two years a dysentery bacillus, *B. flexner*, was recovered after all passage of mucus had ceased, but from him on many occasions during the thirty-five days between the onset of the disease and the final positive result. No mucus was seen after his fifth day in hospital. It is therefore very rarely that dysentery bacilli are recovered from adults when the presence of mucus is not demonstrable if a thorough search for it is made. But this is not true for children. *B. flexner* was a common cause of "green diarrhœa," with or without mucus in the stools, and when mucus was present the appearance of the exudate was by no means always that of bacillary dysentery. Bile-stained mucus contained some granular debris and a few pus cells and cells from the intestinal mucosa, and the picture was that so commonly seen in cases diagnosed "colitis." Red blood-cells were exceptional.

The manifestation of a Flexner infection in children was not confined to "green diarrhœa," typical bacillary dysentery being not uncommon.

In 127 Flexner infections the exact date of onset was obtained, either of the preliminary diarrhœa, or, where this did not open the illness, of the acute attack. The last day on which the organism was isolated from the fæces is shown in Table V. It will be seen that only 81·9 per cent were free of infection in ten days from the onset, leaving 18·1 per cent still carrying, and 87·4 per cent were free in fourteen days, leaving 12·6 per cent of Flexner cases passing dysentery bacilli for any period up to thirty-seven days from the onset of the illness.

TABLE V.

Day of disease	Flexner cases 127		Shiga cases 6		Schmitz cases 12	
	Cases	Per cent free of infection	Cases	Per cent free of infection	Cases	Per cent free of infection
2nd ..	31	24·4	5	83·3	6	50·0
3rd ..	29	47·2	1	100	2	66·6
4th ..	11	56·9	..	..	..	66·6
5th ..	9	62·9	..	..	1	75·0
6th ..	6	67·7	..	..	1	83·3
7th ..	7	73·2	..	..	1	92·5
10th ..	11	81·9	..	..	1	100
14th ..	7	87·4	..	..	..	..
21st ..	9	94·5	..	..	..	..
35th ..	6	99·2	..	..	..	..
37th ..	1	100	..	..	..	..

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Six infections with *B. shiga* and twelve with *B. schmitz* are also included in the table. From the former the organism was not obtained after the third day of illness, from the latter after the tenth.

On such small numbers it is not justifiable to draw any certain conclusions, but the very marked contrast between the persistence of *B. flexner* and of *B. shiga* in the fæces suggests a reason not only for the difference between the numbers of Flexner and Shiga infections encountered in this as in other investigations in India, but also for the fact that *B. shiga* is the cause either of sporadic cases or of sudden flaring epidemics, while *B. flexner* dysentery goes on steadily all the year round, with a natural rise in incidence in the fly season.

Serological Investigations.

Agglutinogenesis of Local Strains of B. flexner *in Acute Dysentery.*

Some of the results of the serological investigation are difficult at present to interpret.

In order to determine the agglutinin response in bacillary dysentery, and to ascertain whether or not this is of any help in diagnosis, it was hoped to obtain blood serum from 100 cases of acute dysentery on admission to hospital, and on the eighth and sixteenth days after onset. It appears from the results obtained by Manifold and DeMonte that more information would have been gained by testing also one week later. A complete series of three tests was made in forty-five cases only, as the men ceased to volunteer blood for this purpose.

All the sera were put up against Oxford Standard emulsions of the five Flexner types, V, W, X, Z, and Y; Dreyer's technique was employed, and readings were taken after four and a half hours in the water bath. They were also tested against an Oxford Standard emulsion of *B. shiga* and against laboratory emulsions of strains of *B. sonne* and *B. schmitz* received from the R.A.M. College, London. Results were recorded in standard agglutinin units, owing to the very varying degrees of agglutinability of the emulsions, with the exception of *B. sonne* and *B. schmitz* agglutinins, which are shown as percentages of full titre, as we have no standard emulsions of these organisms.

B. flexner agglutinins were already present at the onset of the disease in 75·6 per cent of cases; showed a rise against one or more types in 64·5 per cent; showed a steady fall in 13·3 per cent; showed no change in 22·2 per cent.

One *E. histolytica* infection only was included amongst these forty-five cases, and gave a rise of agglutinins, which was not unexpected, since it was believed to be a bacillary dysentery lighting up an old amœbiasis, though no causative bacillus was isolated.

B. flexner was obtained from the stools of twenty-eight of the forty-five cases. Agglutinins for:—

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B. flexner V	were	present	in	15	or 53·6	per cent of these.
B. flexner W	,,	,,	,,	7	,, 24·3	,,
B. flexner X	,,	,,	,,	16	,, 57·1	,,
B. flexner Z	,,	,,	,,	7	,, 24·3	,,
B. flexner Y	,,	,,	,,	13	,, 46·4	,,
B. shiga	,,	,,	,,	2	,, 7·1	,,
B. schmitz	,,	,,	,,	3	,, 10·7	,,
B. sonne	,,	,,	,,	0	,,	,,

From none of the five cases which showed agglutinins for *B. shiga* and *B. schmitz*, present in all five at the onset and remaining steady throughout the illness, was either organism isolated.

The above results are interesting. Tables VI to XI show the degree of agglutination of fifty-seven Flexner strains by the different type sera, and in these it will be seen that only two were agglutinated by X serum, and that most of the strains appeared to be of W type (Table VI). In Table XII it is seen that our stock W strain, which came from a reliable source, does not give rise to X agglutinins in a rabbit, and yet more than half of the patients examined showed agglutination of X. Moreover, in one of these cases (Lovett) X agglutinins were higher than any other type throughout the illness, yet Lovett has been proved by absorption to be a W type. It appears certain, therefore, that the patient's serum does not respond specifically to the infecting type.

In four *B. schmitz* infections, specific agglutinins were produced in one case only.

In two *B. shiga* cases tested, specific agglutinins were produced in both.

Agglutination of Local Strains of B. flexner.

A large number of strains was inagglutinable, on first isolation, by Flexner serum, but most of them acquired agglutinability after subculture daily in broth for ten days, and as a routine procedure organisms were only tested after such subculture.

High titre agglutinating sera were prepared from rabbits for the V, W, X, Z, and Y types of *B. flexner*, using as antigens cultures supplied by the Department of Pathology and Bacteriology, Royal Army Medical College, London. Ten local strains were also used, but three did not serve as satisfactory antigens, and one was too toxic, and these were abandoned, These ten strains were chosen as representative of the local infection, and were from British and Indian cases, both acute and chronic.

The six for which high titre sera were prepared were Allen, Shaw, Lovett, Jage Ram, Bahadur Shah, and Ram Harak. All organisms investigated were tested against these and the V, W, X, Z. and Y sera, and many against Shiga, Sonne and Schmitz high titre sera, because some during early or late incubation had given the biochemical reactions of these organisms.

Fifty-seven strains of *B. flexner* were tested, and none were agglutinated by any of the last three sera.

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Tables VI to XII show the results of the agglutination tests. The figures represent the percentage of the full titre of the serum to which each organism was agglutinated, and should theoretically show the type to which the strain belongs. Percentages have been raised or lowered to the nearest 5, in order to simplify the tables.

Twenty strains (Table VI) are agglutinated in highest percentage by W serum, and should therefore be of type W. As yet absorption tests have not completed the proof of this.

Strains 8 and 22 are, on this showing, type Y, or closely related thereto, but absorption tests have proved them both to be type W.

Table VII consists of three strains which must provisionally be considered to be of type V.

The strains in Tables VIII and IX are as yet unclassed. Strain 32 resembles strains 8 and 22, but is serologically related to "Shaw," which these are not.

In Table X is the only organism yet tested which appears to be of type X.

Table XI is the most interesting, and it is amongst the strains therein that a type of *B. flexner* of different antigenic structure from those determined by Andrewes and Inman may be present, though we have not yet obtained complete proof of this. Until recently, none were agglutinated, in spite of frequent subculture, by any of the high titre sera prepared for the known Flexner types, but the eight hours' agglutination method advocated by Manifold and DeMonte has not yet been tried.

All except the last seven were agglutinated by one or more of the local sera, so that they are presumably Flexner strains, and both Shaw [40] and Ram Harak [41] when tested very recently showed agglutinability by the type sera, and should properly be removed into other groups, but are retained in their present group for the purposes of this paper because they remained inagglutinable by type sera for nearly two years. It is therefore not impossible that strains 51 to 57 may in time acquire demonstrable serological relationship with the known Flexner types.

As judged by their agglutinability, the fifty-seven strains investigated were divided up as follows :—

B. dysenteriæ Flexner W	38·6 per cent.
B. dysenteriæ Flexner V	5·3 ,,
B. dysenteriæ Flexner X	1·8 ,,
As yet unclassed	54·3 ,,

It appears, however, that the method of classification used by Andrewes and Inman is not in all cases reliable. This has been shown above in the case of Lovett (No. 8). Table XIII gives the result of testing four strains three times, with about twelve months' interval between each test. Other strains similarly tested showed fixed or increased agglutinability, but in these four quite marked changes have taken place. The sera used were usually of 1—5,000 titre or over ; no serum was employed which had not a titre of 1—1,000.

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TABLE VI.

No.	Organism	SERA														
		Patient	V	W	X	Z	Y	Shiga	Sonne	Schmitz	Jage Ram	Lovett	Shaw	Allen	Bahadur Shah	Ram Harak
1	Coulson ..	0	25	50	0	0	10	..	0	..	60	40	100	100	25	10
2	Dent	..	25	30	0	0	25	..	0	..	40	40	10	20	20	10
3	Balderston ..	0	10	20	0	0	15	..	0	..	0	30	20	10	0	30
4	Elliott	..	25	30	0	0	30	0	0	..	0	25	10	0	0	10
5	Lockett, I ..	..	5	10	0	0	10	..	0	..	0	30	20	0	0	25
6	Connell, II ..	..	10	20	0	0	5	..	0	..	10	15	40	0	0	0
7	Mainey ..	1/50	5	10	0	0	5	..	0	..	0	30	25	0	0	0
8	Lovett	0	20	50	0	0	100	..	..	..	0	100	0	0	40	100
9	Jage Ram ..	0	0	75	0	0	0	..	..	..	100	0	0	90	30	0
10	Gopal Singh ..	1/25	0	30	0	0	5	0	0	0	20	0	0	30	25	0
11	Jumma ..	1/50	0	10	0	0	10	0	0	0	20	0	0	10	30	0
12	Long	0	0	10	0	0	10	..	0	..	30	0	0	30	20	0
13	Allen	0	0	20	0	0	0	..	0	..	100	0	0	100	100	0
14	Bahadur Shah	0	0	80	0	0	0	0	0	..	100	0	0	80	100	0
15	Borzier.. ..	..	0	80	0	0	0	..	..	..	40	0	0	40	20	0
16	Cook, I ..	..	0	20	0	0	0	..	0	..	25	0	0	30	30	0
17	Hawkins ..	0	0	20	0	0	0	..	0	..	10	0	0	20	20	0
18	Hildrick Smith	..	0	30	0	0	0	..	0	..	20	0	0	20	80	0
19	Rudman ..	0	0	10	0	0	0	..	0	..	50	0	0	25	10	0
20	Hendricks, I ..	..	0	10	0	0	0	..	0	..	0	0	0	10	10	0
21	Cooke, II ..	..	0	40	5	0	15	..	0	..	10	30	20	0	0	20
22	Morley	..	20	20	0	0	80	..	..	..	0	100	0	0	50	0

TABLE VII.

No.	Organism	SERA														
		Patient	V	W	X	Z	Y	Shiga	Sonne	Schmitz	Jage Ram	Lovett	Shaw	Allen	Bahadur	Ram Harak
23	Pick	..	30	10	0	0	10	..	0	..	0	30	15	0	0	5
24	Gadgill.. ..	..	30	0	0	0	10	..	0	..	0	10	15	0	0	0
25	Lockett, II ..	..	25	0	0	0	0	..	0	..	0	10	5	0	0	5

TABLE VIII.

26	Taylor, III ..	0	5	0	0	0	5	..	0	..	0	10	5	0	0	0
27	Connell, I ..	..	10	10	0	0	10	..	0	..	10	30	30	10	0	5
28	Garbutt ..	0	10	10	0	0	10	..	0	..	0	20	25	0	0	0
29	Rhodes, James	..	10	10	0	0	0	..	..	..	0	10	10	0	0	0
30	Ghulam Mohd.	0	5	0	5	5	0	..	0	..	0	0	0	0	0	10
31	Heath	0	5	0	5	5	0	..	0	..	5	5	10	20	10	0

TABLE IX.

32	Caley	0	0	0	5	0	20	..	0	..	10	30	20	0	0	20
33	Taylor, I ..	0	0	0	0	5	0	..	..	..	0	2	0	0	100	0
34	Modh. Hayat ..	0	0	0	0	0	5	..	0	..	5	5	10	0	5	5
35	Ivatts	..	0	0	0	0	5	..	..	..	5	10	10	0	0	25
36	Hari	1/25	0	5	0	10	0	..	0	..	0	0	0	0	0	10

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Allen was agglutinated on isolation after the routine ten subculturings, by W serum, but only to twenty per cent of its full titre. It was also agglutinated to full titre by Jage Ram and Bahadur Shah sera. A few weeks later it had lost all agglutinability except by its own serum, and the titre of the latter had fallen very considerably, from 1—1,250 to 1—250, the change being probably wholly in the organism and not in the quality of the serum.

This state was retained until quite recently, when it was found to have regained slight agglutinability by Bahadur Shah serum. Jage Ram serum and subculture became contaminated and were lost.

The strain Bahadur Shah has shown small changes, the chief one being the loss of agglutinability by Allen serum.

TABLE X.

No.	Organism	Sera														
		Patient	V	W	M	Z	Y	Shiga	Sonne	Schmitz	Jage Ram	Lovett	Shaw	Allen	Bahadur Shah	Ram Harak
37	Smith, I ..	..	20	25	80	0	0	..	..	..	5	50	0	0	0	0

TABLE XI.

38	Ranga	..	0	0	0	0	0	..	..	..	0	50	50	100	200	100
39	Ram Singh ..	..	0	0	0	0	0	..	..	..	0	0	20	100	100	0
40	*Shaw*	0	0	0	0	0	0	..	..	..	0	0	100	0	0	100
41	*Ram Harak* ..	0	0	0	0	0	0	..	..	..	0	0	100	0	0	100
42	Riffer	..	0	0	0	0	0	..	0	..	0	1	0	0	100	0
43	Smith, II ..	0	0	0	0	0	0	..	..	..	20	0	0	0	0	0
44	Bakshi Khan ..	0	0	0	0	0	0	..	0	..	100	0	0	70	100	0
45	Horner, II ..	0	0	0	0	0	0	..	0	..	10	0	0	5	0	0
46	Roughton ..	0	0	0	0	0	0	..	0	..	5	0	0	0	0	0
47	Hanson ..	0	0	0	0	0	0	..	0	..	0	0	0	25	0	0
48	Ruddock ..	0	0	0	0	0	0	..	0	..	0	0	0	5	0	0
49	Hendricks, II..	..	0	0	0	0	0	..	0	..	0	0	0	20	0	0
50	Brownsea ..	..	0	0	0	0	0	..	..	..	0	2	0	0	0	0
51	Priest	..	0	0	0	0	0	..	0	..	0	0	0	0	0	0
52	Plumb	1/25	0	0	0	0	0	..	0	..	0	0	0	0	0	0
53	Clavin	0	0	0	0	0	0	..	0	..	0	0	0	0	0	0
54	Davis	0	0	0	0	0	0	..	0	..	0	0	0	0	0	0
55	East	1/25	0	0	0	0	0	..	0	..	0	0	0	0	0	0
56	Hanscowan ..	0	0	0	0	0	0	..	0	0	0	0	0	0	0	0
57	Tulleston ..	..	0	0	0	0	0	..	0	..	0	0	0	0	0	0

Lovett, while becoming generally more highly agglutinable, is not now touched by Shaw serum, but has acquired agglutinability by Bahadur Shah serum.

Shaw is an organism which for over a year deposited heavily in broth in twenty-four hours, leaving the supernatant fluid quite clear, a characteristic which was only noticed in a few strains, one of them being Ram

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Harak (No. 41), obviously closely related to Shaw. The latter was at first agglutinated to a certain degree by Z serum, and very slightly by V and Y sera, but later lost all agglutinability except by the homologous serum and by Ram Harak. That this was not the same general loss of agglutinability as was shown by Allen is proved by the fact that Shaw serum had throughout a titre of 1—5,000, which has only fallen since the second test noted in the table. Shaw then gradually ceased to deposit, until now it gives a uniform suspension in broth, and this change has been accompanied by the growth of agglutinability by W serum.

TABLE XII.

No.	Organism	Sera										
		V	W	X	Z	Y	Jage Ram	Lovett	Shaw	Allen	Bahadur Shah	Ram Harak
	Flexner V	100	20	10	0	50	5	10	20	0	30	5
	,, W	10	100	0	0	25	0	100	0	0	23	0
	,, X	20	0	100	40	40	5	10	20	0	80	3
	,, Z	10	0	0	100	0	15	100	40	0	80	3
	,, Y	20	30	50	80	100	0	10	20	0	10	1

TABLE XIII.

Strain—											
Allen	0	20	0	0	0	100	0	0	100	100	0
	0	0	0	0	0	0	0	0	100	0	0
	0	0	0	0	0	..	0	0	100	20	0
Bahadur Shah ..	0	80	0	0	0	100	0	0	80	100	0
	0	0	0	0	0	100	0	0	0	100	0
	5	10	0	0	5	..	5	0	0	100	0
Lovett	5	5	0	0	5	0	100	30	0	0	0
	20	50	0	0	100	0	100	0	0	40	100
	25	60	0	0	100	..	100	0	0	30	100
Shaw	5	0	0	20	5	50	0	100	..	..	..
	0	0	0	0	0	0	0	100	0	0	100
	0	15	0	0	5	..	0	100	0	0	50

Absorption tests have not yet revealed the true nature of Shaw, but it is obvious that in the case of this organism, as with Lovett, the "percentage titre" method of classification fails to place it in its type. Lovett by this method is of the Y type, but is proved by absorption to be a W type. Shaw would at first have been labelled a Z type, and now a W type.

Some of the results obtained in the serological investigation of these strains might be partly explained on the assumption that there are group and specific phases of *B. flexner*. Or it may be that at least some Flexner strains are convertible, under circumstances not determined, into any or all of the different types, that some portions of the mosaic of antigens may be latent and capable of stimulation.

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A Flexner strain was in three instances isolated from two members of the same family, and the organisms of each pair were so closely related, judged by agglutination tests, as to suggest that they are the same organism in different stages of agglutinability. Strain 27 (Connell, I) is agglutinated by Allen serum, strain 6 (Connell, II) is not, otherwise they are identical. Strain 20 (Hendricks, I) like strain 49 (Hendricks, II) became more agglutinable, and also of strains 5 and 25 (Lockett, I and II).

In preparing high titre agglutinating sera against locally isolated strains of *B. flexner*, one fact has been noted, that their titre falls more rapidly than does that of sera made against type strains procured from the R.A.M. College, London, which have been subcultured in laboratories for some years. If the agglutinogenic powers of an organism are a measure of the protective bodies it is capable of stimulating when employed as an antigen, it appears that a well-established laboratory strain will be more suitable for inclusion in a prophylactic vaccine than a strain recently isolated.

An Oral Vaccine.

The vaccine as finally decided upon was an emulsion containing *B. flexner* V and W, and the four local strains Allen, Bahadur Shah, Lovett, and Shaw in equal quantities. It was made by washing off agar in saline, killing at 70° C., and preserving in thirty per cent sterilized glycerine.

The vaccine was given in two doses of one ounce each, each dose containing 90,000 million organisms in all, or 15,000 million of each strain, and was taken in the early morning two hours before breakfast, the only nutriment allowed being a cup of tea, with the idea that this would wash the emulsion more quickly through the stomach.

This method was chosen as the result of animal experiments in which it gave the greatest protection.

No reaction was ever complained of by any of the 1,000 volunteers who have received the vaccine, beyond slight discomfort experienced by a very few. This was described as a feeling as of very mild colic which began within an hour of swallowing the first dose, quickly passed off, and was not followed by diarrhœa. In two cases only was there any severe reaction, two volunteers being seized with violent colic and purging for some hours after their first dose. They had attended a regimental guest night on the previous evening, from which it may be argued that alcohol should be partaken of only sparingly on the night before the vaccine is taken. In neither case was there any reaction after the second dose.

Children from the age of 4 years upwards have received appropriate doses with the same absence of reaction.

The disadvantage of this vaccine is the length of time it takes to make sufficient for any large quantity of men, and this is especially felt in a laboratory which has to deal with the routine work of several hospitals. It will be noticed that the number of organisms in two doses of vaccine is

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nearly fifty times greater than that in the 1·5 c.c. of T.A.B. vaccine which constitutes the usual two anti-typhoid inoculations.

The cost is much smaller than that of Besredka's bilivaccin, being only 3·19 annas for the two doses, as compared with Re. 1, but this is the price of media, kerosene for autoclaving, etc., only, and a method of cost-accounting would undoubtedly find it to be considerably higher than this sum.

It was unfortunately not possible to try the vaccine on any appreciable number of men until July, 1927, when the dysentery season was in full swing, and then only 128 men could be given it.

This number, of course, is much too small a one on which to base any conclusions, but it is worth recording that the results to date in the unit from which these volunteers came are as follows :—

Admission to hospital	Non-vaccinated		Vaccinated	
	Number	Per cent	Number	Per cent
Bacillary dysentery ..	24	3·27	1	0·75
Diarrhœa	13	1·77	0	..
Total	37	5·04	1	0·75

Over one thousand volunteers, British and Indian, have received this oral vaccine since July, 1927, but sufficient time has not elapsed to allow one to judge whether any immunity has followed, except in the unit quoted, and there the occurrence of one or two cases amongst the small number of vaccinated would completely upset the figures.

It was pointed out by the officer commanding this unit that the human element introduces what is probably a very real source of error into the consideration of results of preventive treatment where the treated are volunteers; especially so when, as here, the immediate effects of the treatment are in considerable doubt. The men who volunteer in such a case are the cheerful, healthy type, who would probably be less likely than others to succumb to infection, and are therefore likely to give a false picture of success to a vaccine which may have given them no protection whatever.

In the animal experiments we did not find that feeding rabbits with large doses of an emulsion of either *B. flexner* or *B. shiga* was followed by the appearance of agglutinins in the blood.

A further report on this oral vaccine will follow.

Summary.

(1) Over ninety per cent of dysenteries in the area examined were bacillary infections, and in ninety per cent of these the organism responsible was *B. dysenteriæ* Flexner. Less than ten per cent were caused by *E. histolytica*.

(2) Over ninety per cent of positive cultures can be obtained from bacillary dysenteries if the stool is plated within half an hour of passage. After the stool was more than three hours old, only forty per cent of successful cultures was obtained.

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(3) *B. flexner* appears to persist in the stools much longer than does *B. shiga* in efficiently treated cases.

(4) Fewer errors of diagnosis would be made if cases in which the mucus was acid were treated as amœbic dysenteries, and all others as bacillary dysenteries. This is a suitable test for practitioners who have not access to a microscope or a laboratory.

(5) "Green diarrhœa" in children is frequently caused by *B. flexner.*

(6) Many amœbic dysenteries are probably cases of chronic amœbiasis lit up by an infection with a dysentery bacillus.

(7) Charcot-Leyden crystals are not indicative of amœbic infection in infants.

(8) The agglutinins produced during an attack of Flexner dysentery are not specific to the type of the infecting organism.

(9) *B. flexner* W appeared to be the predominant type in the locality, but the "percentage titre" method of typing does not always lead to a correct classification.

(10) An oral vaccine, consisting of an emulsion of different types of *B. flexner* in saline and glycerine, and administered in a total dosage of 180,000 million organisms, has given satisfactory results in an extremely limited trial. It failed to produce agglutinins in experimental rabbits, as did a similar trial with a *B. shiga* emulsion.

We wish to express our very real appreciation of the willingness with which a large number of the staff of several military hospitals helped us in this investigation in supplying details of cases and in ensuring that all material reached the hospital as fresh as the means at their command would allow.

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Editorial.

LONDON WATER SUPPLY.

THE sources of the Metropolitan water supply are the Thames, 58 per cent, the Lee 25 per cent, and deep wells, 17 per cent. The river waters have to be purified before they are passed into the direct supply, and for this purpose the processes employed for many years were mainly storage in reservoirs and filtration at a slow rate through sand filters. The deep-well waters were usually of such exceptional purity that they could be pumped into supply directly without any purification process.

Most of the river water had to be pumped once, if not twice, before it reached the consumer. During the late war the cost of coal advanced to an unprecedented extent, and the question arose whether some of the river supply might not be chlorinated and pass directly to the filters, instead of being pumped up merely to circulate through the storage reservoirs.

In 1905, Houston had made use of chlorine, derived from chloros, to disinfect the Lincoln water supply, and afterwards continued to treat the water for two months with 1 in 1,000,000 chlorine with satisfactory results. Encouraged by the success of this experiment, and possibly influenced by the results obtained with the armies in the field during the war, when chlorine was used to sterilize the drinking water for millions of men without in any way adversely affecting their health, Houston determined to try the effect of chlorinating the water in the Staines aqueduct and so save the cost of pumping the water up to the storage reservoirs.

It is now fifteen years since the experiment was started, and Houston says, in his twenty-fourth report, that since then some two million people have been supplied with chlorinated water daily without any complaints as regards taste.

It may be of interest if we give a short account of how this happy result was achieved and chlorination adopted for other sources of supply.

Before May, 1916, it used to be the custom to abstract seventy to eighty million gallons of raw Thames water daily and to pass it down the Staines aqueduct to the pumping station, where it was pumped up to the storage reservoirs. After circulating through these reservoirs the water was allowed to flow down the aqueduct to the Sunbury, Kempton Park, Grand Junction and Middlesex works. It was decided to chlorinate the water in the Staines aqueduct to such a degree that the bacteriological results would be as good as those obtained after storage in the Staines reservoirs. Two conditions had to be fulfilled: the water must be free

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from objectionable taste and the cost of the chloride of lime used must be much less than the cost of the coal required for pumping.

The standard to be attained was not a high one, as in the stored Staines water *B. coli* was found in 80 per cent of the 100 cubic centimetre samples and in 40 per cent of the 10 cubic centimetre samples. The tests in May, 1916, were mainly experimental, but in June a constant dose of 0·5 part of chlorine per 1,000,000 was given. After treatment some 70 per cent of the 100 cubic centimetre samples and 99 per cent of the 10 cubic centimetre samples contained no *B. coli*. The sand filters at the East London, Grand Junction, Kempton Park and West Middlesex works received a purer water, bacteriologically, than was customary, and they lasted longer without cleaning. The filtered water from these works was safer and free from any smell, taste or noxious ingredient. The saving in cost exceeded £200 a week.

The conditions of the New River supply in 1916 were very different from those of the Thames. The storage was inadequate and the rate of filtration was about double that practised at the other works of the Board. On an average, as the New River contained a large proportion of well water, the filtered water was very good, but when floods occurred in the Lee Valley it deteriorated and there seemed no way of improving the results except by increasing the storage and the number of filters. The cost of this work would be enormous, as the daily output of the New River works was 30,000,000 gallons. In these circumstances Houston determined to try the effects of chlorinating the water during times of flood. The treatment was started in December, 1916, but had to be stopped in January, 1917, owing to the development of taste troubles, which continued for some time, as the sand adsorbed taste-producing material. The bacteriological results were, however, good, and the treatment was restarted in March and continued during the next year. By the exercise of constant vigilance as regards dosage, practically no complaints as to taste were received, but at least on one occasion the treated water was on the border line in this respect. Houston found that taste troubles were more prone to occur in cold weather and, as the storage was inadequate and the rate of filtration rapid, he commenced experimental work on superchlorination and dechlorination. The chlorinating plant was at Highfield and the dechlorinating plant (SO_2) was at Wood Green, two to three miles lower down the New River, the flow occupying about seven hours. For three weeks all went well, then complaints were received of a muddy, earthy taste in the Hornsey supply. The treatment was stopped, and the taste disappeared in two to three days. It might be suggested that reduction of the amount of chlorine would obviate taste troubles, but Houston did not find this to be the case; reduction sometimes accentuated them. He considered at the time that superchlorination followed by dechlorination was of proved utility, but that New River water so treated might not always be free from taste troubles.

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In his thirteenth Research Report, published in 1920, Houston stated that as regards the Thames water, chlorination succeeds better than storage on the average, and is nearly five times superior during the winter months. The year 1920 saw the solution of the taste troubles which followed the chlorination of the New River water, by the use of potassium permanganate. When the floods were at their worst and a dose of chlorine had to be used, which was almost certain to be followed by taste troubles, potassium permanganate (8 lb. per million gallons) was added just below the point where the chlorine was delivered. As the water improved in quality the dose of chlorine and permanganate was gradually reduced until the amount of chlorine added was too small to cause any taste trouble, when the permanganate was stopped. Dechlorination was practised at Wood Green when the water arriving there contained free chlorine ; this, as a rule, only happened in very cold weather.

Houston found that when the iodoform taste had developed dechlorination was powerless to remove it. The development must be prevented by superchlorination followed by dechlorination or by the use of permanganate, which may be added before, at the same time, or just after the chlorine. After the addition of permanganate it is desirable to remove the precipitate of manganous oxide by filtration. If permanganate is added before, and the chlorine after filtration, an iodoform taste may develop.

Waters vary greatly as regards their susceptibility to taste trouble ; with some it is almost impossible to provoke an iodoform taste, with others it may be extremely difficult to avoid it. In Houston's experience there is a middle dose of chlorine which gives the maximum iodoform taste. Given an increase or decrease of the dose, and the taste becomes less perceptible.

It is usual to chlorinate water after filtration, and this was the process adopted in the many water purification plants supplied to the armies in France and other areas during the late war. But most of the consumers of the London water supply receive water almost as soon as it enters the pressure mains on its way to the service reservoirs, so that it is impossible to chlorinate the water after filtration without a large proportion of the consumers receiving freshly chlorinated water. In the case of the Chelsea works the water is not consumed until after it has left the Putney Heath service reservoirs.

In 1921 it was decided to filter raw river water from an intake near Surbiton and to correct any imperfections in the filtered water by the use of chlorine, an emergency permanganate plant being installed to deal with any taste troubles that might arise. The experiment was started in July, 1921, and continued until January, 1922, when the turbid nature of the raw river water necessitated the use once more of Chelsea stored water. During the period of six months the water contained no *B. coli* in 100 cubic centimetres, and there were practically no complaints as regards taste by the 300,000 people who drank the water.

The Board's Deptford, Kent, well enjoyed for many years a high repu-

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tation for chemical and bacteriological purity. *B. coli* could not be found in 100 cubic centimetres. In August, 1921, however, *B. coli* suddenly appeared in 100 cubic-centimetre samples, but no cause for this could be discovered. It was decided to chlorinate the water, and with a dose of one part per 4,000,000, no taste could be detected at the works, though waves of taste would appear, not always in the same places. If the dose of chlorine was increased a chlorinous taste was noticed, and if it was diminished an iodoform taste appeared. Permanganate was not very successful in removing the taste trouble, as a dose of 1 lb. per million gallons gave the beautifully clear water a pink colour which was considered objectionable. The trouble was got over by using chlorine in the strength of 1 in a million and dechlorinating with sulphur dioxide. About May, 1923, the bacteriological quality of the water improved so much that the treatment was discontinued, nor has it been found necessary since then to revert to chlorination.

In his report for the year ending March, 1922, Houston wrote that he thought chlorination had a great future before it, and might be used for the following purposes: (1) to save the expense of pumping, as at the Staines reservoir where the water was held in reserve and pumping merely circulated the water through the reservoir; (2) under adverse weather conditions, after heavy rain and storms, in the winter months, to prevent deterioration of the supply; (3) to enable abandoned sources of supply to be used again; (4) during severe frosts, when there may be serious wastage owing to broken mains, etc.; (5) during very hot weather, when there is an excessive consumption of water, the occasional use of chlorine may prevent deterioration of the supply through the use of water which has not been stored. September, October and November are the worst months as regards quality of supply, and the use of chlorine in selected cases might be advantageous in these months.

When a filter is first put into action the filtrate is usually not good (for two or three days) until a film forms, and if the partially purified water cannot be run to waste owing to the position of the filter, chlorine might be used until a filtrate of the desired quality is obtained.

There is no evidence that a chlorinated water does not filter as well as a stored water. Chlorine retards the growth of algæ, and the use of chlorinated water has diminished the number of acres of filter beds to be cleaned. Between 1915 and 1924 there was a reduction of 33 per cent in the acreage cleaned.

Rapid filtration plus chlorination is safer than slow filtration minus chlorination. Apart from questions of finance, a chlorination process grafted on perfect filtration is the ideal in the present state of our knowledge.

In March, 1925, Mr. Adams drew attention to effects of phenoloid bodies in the atmosphere, derived from gas works or imperfectly burnt coal, on chlorinated water. These bodies combine with the chlorine and give the water

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an iodoform taste. The reaction did not take place if the water contained a little free ammonia. He stated that chlorinated water should not be exposed to the air in the proximity of towns or gas works, nor mixed with water which has been so exposed.

In the Board's laboratories Houston confirmed Adams's results in all essential points. He found that the air of London contains substances which when absorbed by water react with chlorine to produce an iodoform taste. To prevent the taste the ammonia should be added in advance of the chlorine, a dose of 1 in 10,000,000 may suffice. Ammonia causes a lagging effect, but the ultimate results are better than with chlorine alone. As regards the pollution of river waters, Houston regards the phenoloid bodies in solution in sewage as of more importance than pollution derived from the air. In some cases organic matter acts as a corrective factor, but too much reliance must not be placed on its presence.

Ammonia is a taste preventer, and not a taste remover like chlorine and permanganate, and its use would appear to be especially indicated in the case of well water containing little organic matter, and when the use of permanganate for reasons of colour is considered objectionable.

The suggestion to use ammonia compounds with chlorine was first made by Rideal and Race, and we have published some instructive papers on the subject by Major Harold.

Chlorination of the New River, which was usually only practised in the winter months, was adopted in June and July, 1926, to see if it would be effective in the summer as regards taste and bacteriological results and to observe the effect of adding ammonia as well. It was hoped the treatment would also keep down the algal growth. Good results were obtained.

In July, 1929, owing to the unsatisfactory results in samples from the West Middlesex filters, it was decided to add sulphate of ammonia to the general well at Barnes and chlorine to a general well at Hammersmith. Taste trouble at once appeared; this was traced to the fact that certain filtered water wells at Barnes had recently been coated with some tarry paint. The trouble was overcome by removing some of the superficial paint in the wells and increasing the dose of sulphate of ammonia, in terms of nitrogen, from 0·2 to 0·4 part per million.

In October, 1929, Southwark and Vauxhall filtered water was also treated with sulphate of ammonia followed by chlorine. When the new works at Kempton Park were opened the filtered water from the secondary beds was treated in the same way, and provision was made for treating in a similar manner the filtered water from the East London (Sunbury) beds.

Houston states that when chlorination is preceded by ammonia treatment, the water reaching the consumer may respond positively to the orthotolidin test. This does not mean that active chlorine is still present. It has been found that bacteria will multiply in such a water, and further, when phenol 1 in 1,000 is deliberately added there is no development of an iodoform taste.

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At the Walton works raw Thames water is first stored in the Walton reservoirs and then filtered at a high speed without a coagulant through primary filters. The water is then filtered through secondary filters at a higher rate than is customary with slow sand filters. Finally, the water is treated with ammonia and then with chlorine.

Raw Thames water contains *B. coli* in one cubic centimetre in 80·7 per cent of the samples examined. The final filtrate from the general filter well at Walton contains no *B. coli* in 100 cubic centimetres in 93·6 per cent of the samples examined.

The average rate of filtration through the primary filters is 122·5 gallons per square foot per hour, and through the secondary filters 6·02 gallons per hour. The primary filters were worked for 47·3 hours between cleaning, and 333·4 million gallons of water were filtered through the secondary filters per acre cleaned.

We think Sir Alexander Houston is to be congratulated on the magnificent results which have followed on his patient investigations carried on for so many years.

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Clinical and other Notes.

NOTES ON A CASE OF GLANDULAR FEVER.

By Major R. H. LEIGH, M.C.,
AND
Major F. C. CHANDLER, M.C.,
Royal Army Medical Corps.

As glandular fever is now a clinical entity and appears to have been rarely met with in the Army, it was thought that notes on a case treated in Calcutta might be of interest to others.

Further, owing to the blood-picture simulating that of lymphatic leucæmia, and the changes met with in the lymphatic glands, some anxiety might arise in differentiating between this disease and glandular fever in the early stages.

History of Case.—Patient, aged 31, was admitted to hospital on March 13, 1930, and diagnosed dengue. He complained of swelling and stiffness of the neck, severe frontal headache and of feeling feverish.

Past History.—He had been feeling off colour for about a fortnight, and had been treated in quarters for a week previous to admission. He was a very keen horseman, and had several falls while riding at various times.

In 1927 he had discharge from the right ear with perforation of the drum. In 1929 the left ear drum was found to be perforated.

About March 5, owing to feeling feverish and suffering from headache, he reported sick. On March 8 he noticed his neck was stiff and swollen, more markedly on the right side. He stated the swelling was about the size of a walnut and tender to touch. On left side of neck he could feel enlarged glands.

On admission to hospital the lymphatic glands of the posterior triangles of the neck were enlarged to the size of a large almond, being soft, tender and discrete.

The axillary, epitrochlear and inguinal glands were all slightly enlarged but not tender. The spleen could not be felt on palpation.

There was nothing abnormal in the respiratory or alimentary systems. Temperature was 100·4° F.

Treatment consisted of liquid diet, and occasional A.P.C. powders for headache, the patient being confined to bed. Wassermann test was negative.

On April 4 patient was discharged from hospital pending departure to Europe on leave.

There was no complication, and during his stay in hospital patient

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stated he felt quite well throughout the period. On discharge, the lymphatic glands had considerably decreased in size, but were distinctly larger than normal, and painless and discrete.

The results of blood-counts are tabulated. It will be noticed that there was an early moderate leucocytosis with a marked relative and total increase of the lymphocytes. The latter cells were non-granular and were in reality large lymphocytes. They varied greatly from the usual type. In many instances they were increased in size, the nuclei and cytoplasm being correspondingly enlarged. The nuclei of the cells were often atypical in shape and staining reaction, being notched or showing a wavy irregular edge. In some, the nuclei appeared to be made up of several fragments giving an almost rosette appearance.

On staining with Leishman's stain the colour of both the nuclei and cytoplasm varied from violet to bright red.

The irregular nuclei of these cells at first gave the impression that they belonged to the transitional variety, but as azur bodies were present in the cytoplasm of the majority of them there could be no doubt as to their classification.

It is surmised that they were cells hastily evolved by the lymphatic glands reacting to some unknown toxin.

The red cell picture was normal with the exception that the total count was slightly below normal.

Our thanks are due to Lieutenant-Colonel H. C. Winkworth, R.A.M.C., for permission to publish this case, and to Major J. S. K. Boyd, R.A.M.C., who very kindly verified blood-films.

Date	White blood cells						Red blood cells	
	Total count	Neutrophile Polymorpho-nuclear	Large lymphocytes	Small lymphocytes	Large mononuclears	Eosinophiles	Total counts	Haemoglobin
		Per cent	Per cent	Per cent	Per cent	Per cent		Per cent
14.3.30	16,800	10·5	81	7·5	1	—		
15.3.30		17	77	4	2	—	4,400,000	70
17.3.30	16,600	20	74	4	2	—	4,880,000	
18.3.30		24	73	—	3	—		
19.3.30		13	79	—	6	2		
21.3.30		21	68	6	4	1		
24.3.30		23	67	—	9	1		
27.3.30		44·5	39	6·5	6·5	3·5		
28.3.30		33	50	6	8	3		
30.3.30	5,600	43	48	—	3	6		
2.4.30		35·5	58	—	2·5	4		
4.4.30		35·5	57·5	—	4	3		

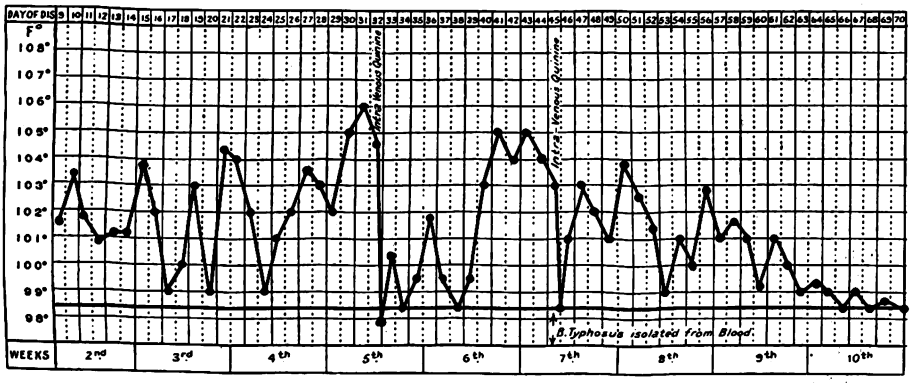
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A CASE OF TYPHOID FEVER WITH PERSISTENT NEGATIVE WIDAL REACTION.

By Major J. B. A. WIGMORE,
AND
Major W. P. CROKER,
Royal Army Medical Corps.

The patient, a girl aged 9½, was admitted to the Military Families Hospital, Mustapha, on February 12, 1930, with a history of malaise, anorexia, headache and pyrexia for eight days.

On admission, when seen by one of us (W.P.C.), she was well nourished and her general condition was bright and cheerful. The temperature was 100·8° F. and pulse 124. The tongue was coated, but clean at the tip and edges. There was some slight abdominal distension, but no tenderness; and rose spots were not detected. The spleen was just palpable. The heart and lungs were normal. Urine—clear, acid, sp. gr. 1020, no albumin. Family history gave nothing relevant to the case. Patient had been inoculated with T.A.B. vaccine, one dose, in March, 1927, prior to sailing to Egypt. Since arrival overseas she had been resident at Aboukir.



A provisional diagnosis of enteric group was made pending confirmation or otherwise by the laboratory.

The laboratory examinations during the first forty-five days of the illness, which for convenience in description may be termed the pre-diagnostic period, were carried out either in the laboratory at the Military Hospital, Ras-el-Tin, or through the kindness of the Director, at the Municipal Laboratories, Alexandria.

In the pre-diagnostic period, Widal tests were carried out on the 11th, 14th, 28th and 31st day of the illness, and on each occasion showed no agglutination with the standard agglutinable cultures of *B. typhosus*, Para A and Para B. The Widal test with the Brucella group, and *B. fæcalis alkaligenes* was also negative. The hæmo-culture was negative to enteric group on the 11th, 14th, 16th and 31st day of the illness.

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Frequent examination of blood-films for malarial parasites and spirochætes of relapsing fever were negative. Examination of the stools was negative for organisms of the typhoid group.

On February 19, a total red blood cell count showed 4,820,000 cells per cubic millimetre, and a total white cell count showed 5,000 cells per cubic millimetre. On March 3, the white cells had fallen to 3,500 per cubic millimetre. On March 12, a white cell count showed a slight relative lymphocytosis.

Polymorphonuclears	59	per cent.
Lymphocytes	34	,,
Large mononuclears	4	,,
Eosinophiles	—	
Basophiles	—	

With these negative findings during this period, it is easy to understand how the provisional diagnosis of "enteric group" faded into the background, and the following diseases were all carefully considered and searched for: Malaria, undulant fever including abortus fever, tubercular peritonitis, relapsing fever, kala azar and schistosomiasis; but each of these in turn failed to fill completely the clinical picture from day to day, and was negatived both by the failure of support from the laboratory findings and by the fact that specific drugs tried in the case of malaria and relapsing fever failed to show any lasting effect upon the pyrexia.

For example, on the thirtieth day of illness, a trial of oral and intravenous quinine was suggested. On the thirty-second day, at 11 a.m., this was given; a rigor followed, and the temperature shot up to 106° F., afterwards falling to below normal by 6 p.m. The temperature rose again the following evening and after fluctuating for a few days rose again to its original level.

The very severe reaction the child underwent appeared to make it very doubtful if it was advisable to repeat this treatment.

The spleen remained enlarged about two fingers' breadth below the costal margin, and on the twenty-second day of illness the liver also became palpable and remained so until it, concurrently with the spleen, began to subside on the fifty-third day of the disease.

The pulse remained approximately 112-130, rising and falling throughout with the temperature, and on the two occasions when the temperature was reduced to normal the pulse remained above 120.

Constipation was marked throughout the entire period of the illness.

Abdominal distension was never a pronounced feature and rose spots at no time made their appearance. Until the fortieth day of the illness the child showed little or no constitutional disturbance, and was often reading, sewing or writing letters; although by this time she was obviously losing ground and weighed only 44½ pounds.

By the forty-fifth day of the disease the patient showed well-marked coma-vigil and delirium, performing remarkable imaginary sewing feats,

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such as the threading of a needle, the knotting of the thread, and the biting off of the same after the work had been completed.

She was then seen by one of us (J.B.A.W.), the D.A.D.P., B.T. in Egypt, for the first time. With great difficulty, owing to the wasted condition of the patient, a sample of blood was obtained and divided between two culture bottles, a couple of cubic centimetres being retained for the Widal test. With a considerable amount of apprehension a second dose of intravenous quinine was given, but the after-effects of this injection proved even more serious than the first. The temperature, as before, dropped to normal but rose again the following day.

A non-motile bacillus was isolated from both hæmo-cultures which, though giving the sugar reactions of *B. typhosus*, was not agglutinated by the College standard agglutinable serum for *B. typhosus*. On subculture the organism became motile and was agglutinated by the typhoid serum to a titre 1/1250. The serum of the patient showed 71 standard agglutinin units for typhoid but no agglutination occurred with Para A, Para B., typhoid "O" College emulsion or the Brucella group. Blood-films were negative to malaria parasites.

On the fifty-second day of the disease there occurred almost suddenly a well-marked all-round improvement; consciousness returned and the child was in every way more rational. There were signs of congestion at the bases of both lungs. The heart, however, continued to function admirably, and by the sixty-fourth day of the illness the lung condition had cleared up, the spleen and liver were no longer palpable and the child had entered the convalescent stage.

This stage was uninterrupted and on the one hundred and second day she was discharged from hospital weighing 60½ pounds.

Commentary.

This case is submitted to be of interest to both clinicians and pathologists, because of a persistent negative Widal reaction and the late stage at which the organism was isolated from the blood.

Gardner, Hobson and Stenhouse [1] have published a similar case but they employed "O" suspensions of *B. typhosus* at the second Widal test, whereas in the case under discussion they were not used before the forty-fifth day of the disease. Had these been used during the initial Widal tests a diagnosis might have been arrived at much earlier. They also employed "O" agglutinating serum against the isolated non-motile organism with positive results. This serum was not available for our case, and until the organism isolated had been subcultured a number of times it was not agglutinated by the stock typhoid serum.

It is interesting that though the organism isolated from the blood on the forty-fifth day of the illness was apparently in the "O" state, yet the serum of the patient was able to produce floccular agglutination with the

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standard agglutinable culture of *B. typhosus* to a titre 1/500. It would appear fortunate that the organism was isolated from the blood, for Felix states: "It is now established beyond all question that after the agglutinins produced by vaccination have disappeared from the blood they can reappear after *many years* under non-specific stimulation of some non-typhoid disease as an anamnestic reaction" [2], and again "in the inoculated *without* regard to the time that has elapsed since inoculation (a) in patients inoculated with the polyvalent T.A.B. vaccine 'H' agglutination must be entirely disregarded." [3] If this is so it would appear that a diagnosis based on a single positive Widal test would have been open to grave doubts, even though inoculation with T.A.B. vaccine occurred three years previously. Dreyer, however, does not hold this view as he denies that pyrexias of non-enteric origin cause a fluctuation in inoculation agglutinations if infection occurs later than *two months* after inoculation, and Manifold supports this view. [4]

Our thanks are due to Colonel J. T. Johnson, D.S.O., M.D., D.D.M.S., British Troops in Egypt, for permission to publish this case.

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[1] *Lancet*, p. 182, January 25, 1930.
[2] *Ibid.*, p. 248, February 1, 1930.
[3] *Ibid.*, p. 506, March 8, 1930.
[4] JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, vol. lv, No. 1, July, 1930.

Echoes of the Past.

THE REMINISCENCES OF AN ARMY SURGEON.

BY LIEUTENANT-COLONEL W. A. MORRIS,
Royal Army Medical Corps (Ret.).

(*Continued from p.* 394.)

ALLAHABAD is the ancient Prayag of early India. It lies a mile or so above the junction of the Jumna River with the Ganges. On its right bank is Papamow, where there is a bridge of boats, and in later years a railway bridge to Fyzabad. Between Papamow and the junction of the rivers are the old cantonment barracks, known as the Chatham Lines. These are very picturesque in a setting of old trees in a beautiful park. They have some sad memories, especially of the massacre of four young officers in a Mess, during the Mutiny, on the first day of their work in the country. At the junction of the rivers stands the Fort of Akbar, a large and formidable fortress, but to-day a store. The modern cantonments are

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two miles from the Fort. When I first lived in Allahabad the trees had not grown, and it was possible to look far out on to the plain. Water was supplied by wells and cholera was indigenous, but malaria uncommon.

One morning I was riding round my small charge when I met General Sir Herbert Macpherson, V.C. I had not seen him since he gave me a wigging, the effects of which had hardly worn off. I saluted him as he reined up to ask me if I was the M.O. of the Infantry lines. I replied in the affirmative. "Then ride with me, I want to look into something." I immediately complied, wondering what was in store for me. He rode straight to the lines, and took me to the third double-storey barrack on the right flank facing the plain.

The General pointed to the barrack and said, "That is where cholera always starts." Entering a room he said, "The first case started in the second bed on the right, the second in the sixth bed, and then a third case in the end bed on the left. Is that true?" I replied, "Yes, sir, that was how it began this time." Then he said, "Yes. At the Fort there was a case at the same time." I then made the obvious reply that they were infected by the same agency. "No," he answered, "it is carried by the air." This air theory was also held by the Surgeon-General of the Government of India, until it was blown to bits by Andrew Duncan, in a paper which I read for him at the Allahabad Medical Society, and which caused us to tremble for our commissions. I am telling this story later. The General then told me that there was water under the bungalow, and asked me if I thought that might be a contributory cause. I would have liked to say no, but the General had far more practical knowledge than I had, so I remarked that it was not good to have water under the bungalow. I then suggested digging, and he fell in with that and gave me the hardest day's work I remember. "Get the men and start at once, I will be here again at 4 p.m." I carried out his instructions and water was found, and the engineers had to drain it away. The General told me that he remembered that there had been a small jheel here before the barracks were built.

Within a day or two the battery left for Shiurajpore cholera camp, with R. H. Sawyer, and I was left with Sherman Bigg to do the remainder of the work as our S.M.O. was down with smallpox.

Cholera started in my lines with seventeen cases, and we were ordered out to camp after the second case. I was exhausted and felt dreadfully ill on my way to camp. When we arrived I staggered away to the shade of a tree and knew nothing more till the next morning. I had had a feeble infection, which nearly laid me low. When I came to my senses I found that Major Walpole had dosed me successfully with the help of the Assistant Surgeon, and I soon recovered.

Life was very pleasant in camp. The Officers' Mess Tent was placed on a bank round a picturesque jheel with a temple of the old days flanking one end. We were within a few feet of the water, so the camp could

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not be regarded as an ideal spot. But these camps had been selected years before and no other choice could be made. The camp and route book was a huge compendium of all the camps and routes in India. A prehistoric Dunlop's Guide. It was very interesting and I spent many pleasant hours over it, but it was shockingly out of date.

The local Rajah asked me to see some of his sick people, and incidentally informed me that all the children of his place were deaf. This aroused my curiosity, so I paid them a visit. Nearly all of them had put a dry pea into their ears, which had become fixed in the cerumen. I had some warm oil put into their ears and rode over in the morning and prised all the peas out with a probe, and started to return, when I was immediately surrounded by a crowd touching me for luck. The Rajah gave me some refreshment and I rode a madcap sort of race with some of his staff in his bazaar. He told off an elephant to await my pleasure for the rest of my time in camp. Every day he was at my tent and became rather trying. I had many pleasant adventures on the elephant, and was greatly interested by the extraordinary sagacity shown by the beast, especially by the way he would test a bridge with his trunk before risking his weight upon it.

It was here that, on another occasion, Hilliard of the 68th and I borrowed two Service mules and went out for a shoot. They were superb specimens of the breed and carried us with comfort the whole distance. I think we almost agreed to give up horses and take to mules. We reached the camp on our return and were walking up the main street to our Mess. To reach this we had only to turn to the right for a few yards. To reach the mule lines it was necessary to turn a similar distance to the left. Hilliard was leading, and his mule wished to go home and not to the Mess. What Hilliard did, I do not know to this day, but suddenly there was increased movement under me. All at once I was shot up in the air, and how near the sky I went I do not know, but I fell into a tent. Hilliard did not get off quite so easily, for he was fired off at a much lower trajectory; his mule seemed to have rifled her shot; he twisted and turned, but luckily also fell into a tent and rolled a huddled mass to the bottom. The mules joined one another and strolled to their lines. We were tough youngsters, and soon found our legs and reached our tents, to be badly chaffed for our misadventure.

We were soon free from cholera in camp, and as it had subsided at Allahabad we only waited an inspection from the G.O.C. before returning. In due course, Sir Herbert Macpherson, V.C., arrived. He called me out at once and asked all kinds of questions as regards rations, cooking, and the nourishment of the men. He first asked me what became of the extras from the beasts slain in camp for rations. I told him the offal contractor bought them. He said, "Do you not think that the men are deprived of much that would be very good for them?" I cordially agreed. The result was that the Mess got the oxtails and the men a soup called "general soup," which they greatly appreciated. Sir Herbert was a great believer in feeding men and transport animals.

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A day or so later we marched to Allahabad. On the last evening I was at the Camp Hospital looking at the packing up, when Private P. walked up and asked for a dose of quinine, which was at once dispensed to him. The next morning, at 4 a.m., I was again at the hospital, and saw Private P. in a dandy and about to be carried on the march. I remembered his asking for medicine, so I did not disturb him. At the half-way halt we had breakfast on what we called "polly stew," and very good it was. During this impromptu meal Captain Carlton told me that P. had a bet on that he would be carried all the way to Allahabad, and that he was not ill at all.

On the completion of the march I made a searching examination of Private P., and could not find anything the matter with him, and told him so. He persisted that he had a pain of an acute character splitting his head into two parts. I determined to run no risks, and ordered his head to be shaved, and two small blisters to be applied behind the ears, and ice to suck, and some milk at intervals. He was to remain in his dandy cot, and be watched. He slept all the afternoon; his temperature never rose above the normal, and he expressed himself as feeling a little better. I showed my pleasure at having aborted a terrible sickness, and continued the treatment. He was anxious to leave hospital, but I counselled him to incur no unnecessary risks, and increased the soda and milk. At three in the morning Private P. was up and asked to rejoin his company. I acceded, and Private P. lost his wager. He did not escape chaff from his friends.

I only remember seeing him twice after this. The first time when he passed me in the barracks, and I asked him if he had paid his bet. He laughed and said, "Some of it, sir," so I paid it. The second time he was in hospital, and desperately ill with double pneumonia, and died. I did all I could for him, poor boy, and I think he was glad that the doctor who had beaten him over his wager stayed with him to the last. I wonder if many in these remarkable days know the strength of the bond of mutual respect and affection between officers and men of the old days. It was very real and very sincere.

I have already mentioned the Allahabad Branch of the British Medical Association, and I now propose to relate its story from its inception to its eclipse.

The idea of forming a branch emanated from the fertile mind of Shirley Deakin, F.R.C.S., the Assistant Civil Surgeon. He was full of energy, a skilful surgeon, and a charming fellow. If he had any fault it was that he gave his opinions too bluntly and sometimes embroiled himself. He was rather in advance of the time. There was no forward movement, no medical scheme, no sanitary improvement that he was not ready to examine and support. Medical affairs were up to date in Calcutta, and represented by a flourishing Medical Society and Gazette. Deakin was determined to bring the medical affairs of the mofussil up to the same standard. It will be conceded that this was a laudable ambition, and

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Deakin at first pursued it with success and vigour. He organized the branch and I was joint honorary secretary with him. We at once started *The Indian Medical Journal*, which Deakin conducted and edited well for two or three years. Surgeon-Major J. P. H. Boileau, A.M.D., was treasurer, and our popular P.M.O., Dr. Hendley, president.

We held meetings every month at each other's houses. These included showing cases and reading papers, and were very pleasant and informal. They were also of much instructional value. We were well supported and our membership was encouragingly large, and included some well-known men. I will name some of them. Keegan, of the I.M.S., with a remarkable record of successful stone cases; Temple Wright, of Khandwa, and his gifted wife. This lady wrote some interesting books, and was an authority on gardening. R. H. Quill (later a surgeon-general) wrote some interesting articles, he was stationed at the old Mahratta fort of Assirghur; Jack, of Baraich; Robertson, of Chitral, who afterwards so distinguished himself as a politician. Arthur Sloggett, afterwards D.G. He was at Landour, a well-known hill station. Keogh was at Dinapore. Lukis, of Agra, afterwards D.G., I.M.S.; Tylor, of the Agra gaol, a civilian, and Dr. Murray, the chemical examiner; Irwin, now Sir Murray, and a major general. Geoffrey Hall was one of our regular attendants and taught us a lot about eyes.

We were further honoured and encouraged by Surgeon-General Sir Anthony Home, K.C.B., V.C., but we were not much in the favour of Sir Benjamin Simpson, the head of the I.M.S., and for a good reason which I shall relate directly.

Sir Anthony was a most distinguished soldier doctor, but rather exclusive and unsociable. He could be cynical, and was strict. I think that it was a shyness from which he could not escape that caused him to be dreaded by doctors and unpopular with others. He was a great administrator and a very brave man.

Surgeon J. Jerome was also a member of our society. He was with me at King's and I knew "Jerry" well. Now, Sir Anthony was daily expected at Allahabad, and Mr. Traynor, the assistant-surgeon at the Rest Camp who met every train, was warned to watch for the great man. One morning Traynor saw a little man get out of a first-class carriage. Immediately he asked him his name, and Jerry said "Surgeon Jerome." Traynor waited on him and carried his luggage, procured a cab, and when he had seen him out of sight tore away to Dr. Hendley and told him that Sir Anthony Home had arrived. He immediately communicated with the hospital and everyone was warned and ready for inspection. Nothing happened until Jerry arrived at the P.M.O's. office to report himself. Dr. Hendley asked if he had travelled with Sir Anthony or had seen him. Jerry spoke of the great attention he had received, and it then appeared that he had been mistaken for Sir Anthony.

A few days later Sir Anthony did arrive, but not surreptitously, for I do

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not think he would ever take such an advantage. It so happened that there was a meeting of the society the same night. A very brilliant paper by Andrew Duncan was to be read by me on the subject of cholera, with especial reference to Surgeon-General Simpson's air theory. What an opportune time to have Surgeon-General Sir Anthony Home. It was my duty to send the official invitation. I was terrified, but at the cost of much ink and paper I got it off. Imagine my pleasure and surprise when I received a charming and courteous note thanking us for the invitation and expressng his great regret that he was obliged to reach Cawnpore that evening. He desired that his letter should be read and he cordially wished us all success. We were very pleased to receive this letter.

Now I come to the *débâcle* of the Allahabad Branch of the British Medical Association, at which Sir Anthony Home was within an ace of being present.

There had been a Congress of Hygiene at Venice at which Surgeon-General Sir Benjamin Simpson read a paper on the "Sanitary Tendencies of State Sanitation." The views of the Surgeon-General were new and startling. Moreover, they were regarded in India as thoroughly unorthodox. Andrew Duncan championed our cause. He had returned comparatively recently from the Afghan frontier where he had experienced much cholera and brought his powerful intellect to focus on it, in fact he had written an essay which eventually won the Parkes Memorial Prize. Dr. Simpson's theories had fairly aroused Duncan, and he wrote a scathing paper to the society and asked me to read it. He called it "The Insanitary Tendencies of State Sanitation." I read the paper and considered it a masterly indictment of the Surgeon-General which I should appreciate reading. Deakin also saw it and agreed with me. No one else saw it.

The meeting took place at the residence of Dr. Hendley and after a good dinner we all assembled to hear Duncan's paper. I read it carefully and emphasized all the sarcasm of Duncan's clever exposition which crumpled up the Surgeon-General. In my defence I would urge that I was young and inexperienced in Service ways. When I had finished Dr. Hendley looked very uncomfortable and grave and the rest of the seniors looked astonished at the manner in which the views of the Surgeon-General had been torn in shreds. When I had flung the last brick I sat down to contemplate the result. I felt that from a scientific point of view it was a signal victory, for I did not appreciate its disciplinary aspect. Dr. Hendley from the first showed strong disapproval and regretted that such an abuse of the Surgeon-General with the Government of India should have taken place in his house. He said officers had every right to air their views, but not in this way. Surgeon-Major Boileau agreed with him and disapproved the paper. Up jumped Deakin and assured everyone that personalities were not to be considered. He agreed with every word that Duncan had written, and he would like to hear what the Surgeon-General's reply would be. He was sure that Dr. Simpson would be the last to

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desire the truth strangled, and having reconsidered his air theories would whole-heartedly agree with Duncan. He thought that questions of discipline should not enter this matter. However, Dr. Hendley ruled any reference to the matter as out of order while he was present and we loyally accepted his decision. Later, when we had reached our homes and had had time to reflect, there was not a shadow of doubt that we had scalped the Surgeon-General.

A few days later the P.M.O. received a communication from Simla, which alarmed him, for he hinted at possible resignation. We also realized that something unpleasant would happen to us, as we heard that Sir Benjamin had taken serious umbrage at our conduct. However, he was a sportsman and a thoroughly good fellow and though naturally annoyed took no further notice. It was different with Duncan, who belonged to his service. He received a reprimand from his General. Deakin never survived. He was ordered to Bunnoo, a place he detested and where he was cramped in every direction. He became infected with enteric fever and died. I lost a great friend and I miss him to this day. He would have had a great future if he had been handled a little more tactfully in his earlier service. The shock eclipsed our little Service society, and only one committee meeting was held afterwards. It came about in this way. Many years afterwards I paid a visit to my old chief, Surgeon-Colonel J. P. H. Boileau, at Trowbridge, where he held a half-pay appointment. It will be remembered he was our treasurer. While I was with him we discussed the old days, and he told me that he had a few pounds belonging to the society in his possession. We formed a committee and as I was on the active list he put me in the chair. He read the minutes of the last meeting and proposed, and I seconded, that the balance should be forwarded to dear old Shirley's widow. He then formally completed the proceedings by writing to tell me that he had filed an acknowledgment of the gift.

(*To be continued*).

Current Literature.

EDWARDS, J. T. **Bovine Tuberculosis in India.** *Far Eastern Ass. Trop. Med. Trans. Seventh Congress, British India*, 1927. v. 3, 598-602. [Imperial Inst. of Vet. Research, Mukestar.]

"The general impression has been that tuberculosis is so rare in India, that it hardly merits attention." The writer of this paper, which is really an address given to the Seventh Congress of the Far Eastern Association of Tropical Medicine, sets out to investigate this statement.

The number of careful examinations made upon cattle in India for the detection of tuberculosis have not yet been many, but so far as they have gone they would seem to corroborate the general impression that bovine

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tuberculosis is rare. A few years ago examinations of carcases of slaughtered cattle at Ferozepore by TAYLOR and at Cawnpore by OLIVER revealed macroscopic lesions in approximately 3 per cent. of the animals. The lesions, were, however, invariably minute in extent, localized to the tissues in which they are most commonly found, and retrogressive in their appearance. A few cases had also been noted in Madras (among conservancy bullocks), in Bombay Presidency, and in Calcutta Jail. In 1923, however, W. SMITH declared from an experience extending over many years among military dairy cattle all over India, that he was unacquainted with the disease. In 1923-24 an enquiry made under the direction of the author's Department at Lahore and Ferozepore slaughter-houses, failed to discover lesions in carcases subjected to an ordinary examination such as is commonly performed in meat inspection.

Laboratory examinations to determine the so-called types of tubercle bacilli found in various kinds of lesions in human tuberculosis in India have not yet been conducted upon a scale sufficient to warrant any conclusion as to the origin of infection, but at the Second Conference of Veterinary Officers in India held in 1923, HUTCHINSON made the important announcement that the incidence in the forms of tuberculous disease, a high proportion of which is known in Europe to be caused by bacilli of the bovine type, bears in India almost exactly the same numerical relationship to the other forms as has been calculated to exist in Europe. *A priori* this statement points to the presence of bovine infection in India, and would suggest that investigation is needed.

In 1923, therefore, the Indian Research Fund Association started an investigation on two questions: (1) Are Indian cattle more resistant to tuberculosis than are the cattle of European origin? Are the tubercle bacilli that give rise to the relatively mild tuberculosis occasionally detected among cattle in India of lower virulence than the bacilli isolated from the grave lesions of cattle in Europe?

Calves from the important breeds of cattle all over India, calves containing a considerable mixture of European blood (used as partial controls), and buffalo calves of various breeds were tested by subcutaneous inoculation of 50 milligrams of a young culture of a bovine virulent strain sent from Dr. Stanley GRIFFITH in England. There were no pure-bred European calves of the requisite age used in the test, and the results were, therefore, to some extent inconclusive. A large proportion of the calves succumbed to acute generalized infection within three months, in the same manner as calves in Europe are known to do; the buffalo calves proved as susceptible as the other calves. A considerable number of calves, however, displayed a high degree of resistance and recovered from the test; amongst these was a fair number of calves with a mixture of European blood [actual figures not given]. It might be concluded from the results of such an experiment that a noteworthy proportion of Indian cattle possess a hereditary resistance against tuberculosis which distinctly surpasses that observed in

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European cattle. Strains of tubercle bacilli isolated by Dr. SOPARKAR from the restricted lesions observed in Indian cattle, proved, however, after appropriate animal inoculation, to be fully as virulent as control strains of highly virulent bovine bacilli obtained from Europe. The results were communicated by Dr. SOPARKAR in another paper at the meeting.

There would seem to be good reason, therefore, to believe that the low natural incidence of bovine tuberculosis in India is to be found in the open-air life of the cattle, which remain out of doors throughout their lives and, therefore, escape the massed infection of housed cattle which takes place in Europe. There is, indeed, further evidence to believe that when cattle in India are housed under conditions simulating those of Europe, a high incidence of clinical tuberculosis may develop in the herd after introduction of infection (Quetta military dairy). The existing infection among indigenous cattle as disclosed by the laboratory tests would appear to be no less virulent than that of Europe; its dissemination among animals would thus take place, after voidance from carriers, in circumstances which would render infection operative only through the medium of minimal doses, probably frequently repeated, so that the existence of a preceding infection within the tissues would set up a vaccinating effect against each succeeding dose of virulent material. There is now further information which lends considerable support to this hypothesis, and, moreover, makes it necessary to recast some of our former impressions concerning the relatively low incidence of natural bovine tuberculosis in India and the mechanism of resistance among some cattle in the country towards artificial infection. In the course of very searching examinations carried out by Dr. SOPARKAR last cold weather at the Lahore and Ferozepore slaughter-houses, he found macroscopic evidence of tuberculosis in over 15 per cent. of the carcases of cattle. In nearly all these cases the tuberculous nature of the lesions could be confirmed by detection of the bacilli or histological examination.

The presence of reactors to the tuberculin test which show no lesions upon slaughter, and the presence also of obscure lesions in carcases in which a diagnosis of tuberculosis would most likely be missed by a man who was not highly expert at the work of detection, would suggest that the ordinary subcutaneous tuberculin test, as applied to Indian cattle, may be unreliable. The intra-palpebral test and the double intradermal test have now been substituted for the old subcutaneous test. The author has not yet encountered any cases of macroscopic affection of the udder with tuberculosis.

Among other work already accomplished in the course of this enquiry is the search for tuberculosis in other species of animals in India—horses, swine, camels, elephants. The author has reason to believe that horses are affected with both bovine and avian types of bacilli. Swine have been found by Dr. SOPARKAR to be affected, in the few cases he has examined from Bombay, with the human type pre-eminently, but also with the bovine

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type. He has found an example of mixed bovine and avian infection in cattle and of a cervical tuberculosis caused by the avian type of bacillus in man.

S. Roodhouse Gloyne.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 7.

Knorr, M. Typhus und Trinkwasser. (Eine epidemiologische Studie ueber die Pforzheimer Typhusepidemie 1919. **[Epidemiological Study of Water-borne Typhoid.]** *Arch. f. Hyg. u. Bakt.* 1929, v. 102, 10-36, 6 figs. & 5 plans. [28 refs.] [Hyg. Inst., Univ., Munich.]

An inductive study of the serious epidemic of typhoid in Pforzheim, in 1919, which was responsible for more than 2,000 cases. It is first shown that the regional distribution of the cases was too uneven to be likely to have arisen by chance and that the distribution corresponded to that of different water supplies. It is next shown that the distribution in greater or less dilution of a particular supply corresponded with the greater or less incidence of typhoid. Finally it is shown that the impugned source was liable to specific contamination from a cottage in which a case of typhoid had occurred and that the time relations of the epidemic were consistent with this origin (the study was simplified by the fact that the epidemic began in winter and that a relation with the point in time when a thaw occurred could be made out).

M. Greenwood.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 8.

Ceredi, A. La verdura nella epidemiologia della tifoide. **[Green Vegetables in the Epidemiology of Typhoid Fever.]** Reprinted from *Igiene Moderna.* 1929, v. 7, No. 1, 16 pp. [23 refs.] [Hyg. Inst., Univ., Bologna.]

Ceredi carried out experiments which confirmed the difficulty and even impossibility of disinfecting salad which had been contaminated by typhoid bacilli, either by subjecting it to prolonged washing in running water or by using those disinfectants which do not cause a change in the salad even in very high doses, viz., hypochlorites, chloramine, organic acids, etc. As regards the use of various disinfectants it should be noted that even with moderate doses which are sufficient to disinfect very impure water a certain effect may be obtained, but this effect does not become more pronounced in proportion to the increase in the dose.

Ceredi has been unable to find substances capable of increasing the action of the disinfectant. He tried, without success, salts, diluted acids and bases, and alcohol, and passage of the constant current through the solution in which the lettuce was placed. It was found that typhoid bacilli sprinkled over salad resist the natural agents of destruction for a period

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not less than a fortnight. It cannot be denied, however, that their number becomes greatly reduced and that possibly under natural conditions the contamination is never so great as in experimental conditions. Owing to the impossibility, however, of completely disinfecting green vegetables, Ceredi recommends that measures should be taken to prevent green vegetables which have been contaminated by sewage being ever used for human consumption. [This subject has considerable interest for dwellers in the tropics and it is to be noted that this author's results are at variance with those obtained by MILLS, BARTLETT and KESSEL (this *Bulletin*, 1926, v. 1, 64) who found chlorine effective. It would have been interesting to have confirmation or otherwise of the finding of the same authors that dipping in boiling water for 10 seconds will "uniformly kill all pathogenic bacteria, protozoan cysts and helminth eggs which might be found contaminating such food products."—ED.].

J. D. ROLLESTON.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 8.

PIJPER, A. **Seriological Diagnosis of the Enterica.** *J. Hygiene.* 1930, v. 29, 380-93, 1 fig. [28 refs.]

The author records a series of cases of enteric infection, occurring in South Africa, which afford an excellent illustration of the importance of testing a patient's serum for O as well as for H agglutinins, as advocated by FELIX. (Certain of the protocols in this paper afford examples of the curious anomaly that the serum of a typhoid patient may give so-called 'O agglutination' with a suspension of *Bact. paratyphosum* A, while the serum of a patient infected with *Bact. paratyphosum* A may produce a similar result with a suspension of *Bact. typhosum*, although there appears to be no relationship between the main O antigens of these two bacterial species, as revealed by the work of Bruce WHITE and others.)

W. W. C. TOPLEY.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 8.

GARDNER, A. D., HOBSON, F. G., & STENHOUSE, G. **A Case of Typhoid Fever with Persistant Negative Widal Reaction but Positive "O" Agglutination.** *Lancet.* 1930. Jan. 25, 182.

The case here recorded is of interest as illustrating possible difficulties in the bacteriological diagnosis of typhoid fever, and the way in which they can be overcome by the application of recent advances in our knowledge of the antigenic structure, and variability, of the typhoid bacillus.

The patient presented the clinical syndrome of typhoid fever, but agglutination reactions carried out with standard formolized cultures were negative on the 17th and 23rd days of disease. A blood culture yielded a bacillus which had the characters of *Bact. typhosum* except that it was non-motile.

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The specimen of serum obtained on the 23rd day was tested against two 'O' suspensions of *Bact. typhosum*—one an alcoholized suspension of a normal smooth strain, the other a formolized suspension of a non-motile 'O' variant—and in each case agglutination occurred to a titre of 1 : 125. Later tests gave confirmatory results. The non-motile bacillus, isolated from the patient's blood, was agglutinated to titre by an 'O' agglutinating serum. It showed no 'H' flocculation with an ordinary antityphoid serum, though it gave slow granular agglutination in the lower dilutions. From this non-motile strain, a motile variant was obtained which was fully agglutinable by an ordinary 'H' antiserum.

The patient was clearly infected with a strain of *Bact. typhosum* in the non-flagellated 'O' condition, and had therefore failed to produce the usual 'H' (flagellar) agglutinins.

W. W. C. Topley.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 8.

Grassl. Die vermutlichen Ursachen des Gebirgskropfes. **[The Probable Causes of Goitre in Mountainous Districts.]** *Muench. Med. Woch.*, 1929, v. 76, 1375-7. [4 refs.]

Two factors have a profound influence on the metabolic processes that occur in all animals, namely the amount of iodine in their food, and the amount of ultra-violet radiation they receive on their skin. Under the influence of ultra-violet radiations animals store up iodine in their thyroid glands and blood. It is not surprising therefore that seasonal variations in the iodine content of the thyroid should be the rule. The amount of available ultra-violet radiation is greater in mountainous districts than on the plains, and at the same time the amount of available iodine is often less. It is suggested that this discrepancy between excess of radiation and relative deficiency of iodine is responsible for the occurrence of goitre in mountainous districts.

S. J. Cowell.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 8.

Stiner, O. Kropf- und Längenwachstum. **[Goitre and Height.]** *Schweiz. Med. Woch.* 1929, Nov. 2, 1102-4, 2 figs. [2 refs.] [Federal Health Office, Berne].

It is contended in some quarters that endemic goitre and short stature are intimately related to one another. Records of the height measurements of recruits of the Swiss army appear to support the view that the average height of Swiss males has been increasing steadily during the last 40 years. Thus, the average height of the recruits in the Canton of Berne during the years 1888 to 1890 was 162·9 cm., during 1908-1910, 165·2 cm., and during 1926 to 1927, 176·4 cm. In many other cantons a similar increase in stature has taken place. When the heights of individuals are correlated with their thyroid status, it is found that the average height of men with

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diffuse or colloid goitres is in most cantons very appreciably greater than that of men with no goitre or with adenomatous goitres. In 24 out of the 30 districts in the Canton of Berne the recruits with colloid goitres were taller than those without goitres, and the mean difference in height between the two groups of men in one district was 3·2 cm. While no definite conclusions are drawn from these figures, it seems unlikely that the mere existence of an enlarged thyroid gland can be in any way responsible for shortness of stature.

S. J. Cowell.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 8.

Mazzocco, P. Investigaciones sobre el bocio endémico y su profilaxis. **[Investigations into Endemic Goitre and its Prevention.]** *Semana Méd.* 1930, v. 37, 356-73, 2 figs. & 7 graphs. [37 refs.] [Physiol. Inst., Faculty of Med. Sciences, & National Hyg. Dept., Buenos Aires.]

This article consists of a series of papers each recording the results of a separate study, but closely inter-related as throwing light on a complex subject. The work to which they refer was initiated by the National Health Department of Buenos Aires in 1924 and has been going on for the past six years. Briefly, the object aimed at was a determination of the iodine content of the air, water, soil, dew, and articles of food in Salta and Buenos Aires, for comparing the former in which goitre and cretinism are endemic, with the latter which are not so affected. After preliminary remarks on the physical geography of the Province of Salta comes a paper on the amount of iodine in the air, dew, soil and water, with a description of the apparatus and methods used for making the estimation. The results are expressed in microgrammes, i.e., thousandths of a mgm. (0·000,001 gm.). In the Capital Federal the amount was found to be 0·8 mmgm. per cubic metre of air, whereas in the air of Rosario de Lerma and Campo Quijano (goitrous districts) its presence could not be determined at all. In the dew of Capital Federal it was 3 mmgm. per sq. metre, whereas at the other places under similar conditions of collection none was found. In the soil of Buenos Aires the amount varied between 1,800 and 2,800 mmgm. per 1,000 gm. in different parts of the Province, whereas in Salta the figures were very low. In 18 districts the majority gave under 200 mmgm., the lowest being Tastil 140, and Rosario de Lerma 155 mmgm. and only one, Rosario de la Frontera, gave above 600 mmgm. Of 28 waters examined in the Province of Salta the lowest content was 0·3 mmgm. per litre, twenty-two were below unity and only one reached 2·5 mmgm. Of several samples in Capital Federal the lowest figure was 2·2 and the highest 6·2 mmgm., while in the Province of Buenos Aires the lowest was a well water at Banfield, analysis of which gave 8·3 mmgm., and the highest at Wilde 32 mmgm., per litre. A large number of foodstuffs are mentioned in another section comprising beef, cow's milk, eggs, grass pasturage, and

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between twenty and thirty species of vegetables and twelve samples of cereals, and the results may be summed up by saying that the iodine content in areas where goitre was endemic was about half that in healthy, non-goitrous districts. A fourth paper details the analyses of many thyroid glands of sheep of various districts, results being presented in tables and in graphs. These may be epitomized by saying that in Buenos Aires the average was above 100 mgm. per 100 gm., whereas in Potrero de Linarea, La Caldera, Molinos (goitrous districts) the glands though enlarged contained a very low percentage, and in Cachi and La Cebada (also goitrous) even when the glands were not enlarged the relative content in iodine was small. The conclusion is that in the endemic areas administration of iodine, as by means of iodide salt, is justifiable as a prophylactic measure.

H. H. S.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 8.

GRIFFITH, A. S. **Types of Tubercle Bacilli in Human Tuberculosis.** *J. Path. & Bact.* 1929, v. 32, 813-40. [17 refs.] [Field Labs., Univ., Cambridge.]

In this paper the author brings up to date the results of the long series of investigations made by his colleagues of the Tuberculosis Commission and himself, on the types of tubercle bacilli. [See *J. Path. & Bact.*, 1928, v. 31, 875, for cases of human bone and joint tuberculosis.] The total number of cases investigated is given in a table in his summary of the article (see page 462).

In cervical gland tuberculosis the results of the investigation are summarized in a number of tables, and are classified as primary or secondary according to whether there was no clinical evidence of tuberculosis of the chest or of abdomen. In discussing the cases of tuberculous meningitis the author points out that in the great majority of the autopsies on meningitis cases, the oldest lesions were in the thorax, and in all but one of these thoracic cases the tuberculosis was caused by tubercle bacilli of the human type. In the remaining meningitis autopsies the distribution of the lesions pointed to the alimentary tract as the point of entry, and these cases were generally of the bovine type.

A series follows in which the writer gives the results of the examination of tuberculous material obtained at autopsies. Amongst these were 34 cases of primary abdominal tuberculosis from which tubercle bacilli were recovered in 16. In 6 of the 16 cases the primary lesions were in the intestines or the mesenteric glands. Four were infected with bovine, one eugonic human and one with dysgonic human bacilli. In none of these cases were the bronchial glands obviously tuberculous. In seven of the remaining cases, all of which were infected with eugonic human bacilli, the anatomical evidence was definitely in favour of the respiratory tract as the portal of entry of the bacilli. In one of the cases, entry by more than one route was indicated by the equally advanced caseation of the cervical,

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mesenteric and bronchial glands. In the remaining two the anatomical evidence was inconclusive. Of the 18 cases of primary abdominal tuberculosis from which no tubercle bacilli were recovered in cultures there were lesions in the mesenteric glands, one or more of which contained calcareous, or calcareo-caseous substance.

In Table IX the author has classified into groups, according to the probable portal of entry of the tubercle bacilli, 171 autopsies on persons in whom macroscopic tuberculous lesions were found and bacilli of one type only were present.

A complete summary of bacteriological results in all the autopsy cases is also given. It comprises 319 autopsies. The cases fall into 3 groups: (1) 96 children in whom no macroscopic lesions of tuberculosis were discovered in any organ or gland; (2) 47 cases in which there were macroscopic lesions of tuberculosis, but living tubercle bacilli were not demonstrable in the tuberculous material investigated; (3) 176 cases in which there were lesions of tuberculosis and in which cultures of tubercle bacilli were obtained. The results of typing these strains and 7 strains from the first group are summarized in the second table.

Griffith also gives a miscellaneous group of cases including Addison's disease and others in which he obtained 21 human strains and two bovine out of a total of 23.

English Statistics.

Form of tuberculosis	Number of cases	0—4 years			5—14 years			14 years and over			Percentage bovine all ages
		H.	B.	B. %	H.	B.	B. %	H.	B.	B. %	
Cervical gland ..	116	3	18	85·7	28	26	48·1	32	9	21·9	45·7
Bone and joint ..	511	60	24	28·6	277	65	19·0	81	4	4·7	18·2
Urogenital	23	0	0	0·0	2	1	33 3	17	3	15·0	17·4
Meningeal	33	2	1	33·3	13	7	35·0	9	1	10 0	27·3
Autopsies	183	72	29	29·7*	48	7	14·3†	21	1	12·5‡	22·3
Miscellaneous ..	23	2	1	33·3	10	1	9·1	9	0	0·0	8·7
Scotch Statistics.											
Cervical gland ..	17	1	3	75·0	3	7	70·0	1	2	66·6	70·6
Bone and joint ..	30	12	6	33·3	8	2	25·0	2	0	0·0	26·6

* Including one of the two mixed viruses. † Including one mixed virus.
‡ Including two mixed viruses.

Finally he discusses a group of autopsies in which apparently negative tuberculous lesions failed to yield living tubercle bacilli in cultures or on guinea-pig inoculation.

A striking feature of these lesions was the presence in them of abundant well-formed tubercle bacilli. The author says: "It was at the first experience difficult to believe that these bacilli could have been dead, and the possibility was considered that they were attenuated forms, or living tubercle bacilli of another type, incapable of producing tuberculosis in

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guinea-pigs. In subsequent experiments emulsions of glandular material were used not only to inoculate guinea-pigs but also to sow cultures; in addition cultures were sown from the glands and organs of the guinea-pigs which had been inoculated with the material. All the experiments, both cultural and animal, were negative. The evidence, therefore, is conclusive that the tubercle bacilli seen in the lesions were not living tubercle bacilli, either attenuated or of the avian type. They were dead."

TABLE IX.

Probable portal of entry	Number of cases	Type of infecting tubercle bacillus		Percentage bovine
		Human	Bovine	
Alimentary tract	39	6	33	84·8
Respiratory tract	100	99	1	1·0
Two routes, respiratory and alimentary ..	25	25	0	0·0
Uncertain	7	7	0	0·0

Age periods	Number of cases	Types of infecting tubercle bacilli				Percentage bovine*
		Eugonic human	Dysgonic human	Bovine	Mixed human and bovine	
Under 5 years	103	72	0	29	2	29·1
5 to 9 years ..	50	42	1	6	1	14·0
10 to 14 years	6	5	0	1	0	16·6
15 and over ..	24	20	1	1	2	12·5
	193	139	2	37	5	22·4

* Including four of the mixed infections, but excluding H 13 "A.D."

Organs containing the healed lesions	Number of instances	Tubercle bacilli found in	Guinea-pigs inoculated with negative results	Cultures negative in
Cervical glands	41	19	63	32
Mesenteric glands ..	42	15	98	14
Bronchial glands ..	8	5	19	7
Lungs	11	3	22	4
Spleen	3	—	7	1
Liver	1	—	2	—
Kidney	1	1	2	1
Bones and joints ..	62	2	80	38
Skin	9	—	12	—
	178			

S. Roodhouse Gloyne.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 8.

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DE QUERVAIN, F. Zur Kropfprophylaxe durch Jodkochsalz. [Goitre Prophylaxis by Means of Iodized Salt.] *Schweiz. Med. Woch.*, 1929, Nov. 2, 1099-1101.

Vigorous opposition to the use of iodized salt in Switzerland has been advocated by Dr. F. BIRCHER (this *Bulletin*, 1929, v. 4, 1019), who has collected references from 38 papers drawing attention to the dangers of iodine medication in goitrous districts. These dangers are, however, already recognized by all experienced physicians and surgeons working in centres of goitre endemicity, including those who strongly advocate goitre prophylaxis by means of iodized salt. Indiscriminate treatment by iodine of goitres already present in adults is known to cause symptoms of hyperthyroidism, although there is virtually no risk of producing unpleasant symptoms in children by giving iodine preparations under skilled medical supervision. Many of the criticisms are levelled against the use of iodized salt and a large proportion of these are derived from American sources. Seeing that the Americans add 40 to 100 times more iodine to their salt than is recommended in Switzerland, it is not to be wondered at that cases of hyperthyroidism arise in America that may be directly due to overdoses of iodine. It remains the fact that the physiological doses of iodine recommended by the Swiss Goitre Commission have not been proved to cause symptoms of hyperthyroidism. Iodine prophylaxis of goitre is an empirical discovery and its recommendation does not imply a belief that iodine deficiency is necessarily the fundamental cause of endemic goitre.

S. J. COWELL.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 8.

LÖWENSTEIN, E. Die Methodik der Reinkultur von Tuberkelbazillen aus dem Blute. [Cultivation of *Mycobacterium tuberculosis* from the Blood]. *Deut. Med. Woch.* 1930, v. 56, 1010. [1 ref.] [State Serotherap. Inst., Vienna.]

The author records the successful isolation of tubercle bacilli from the blood by the use of a special technique. The medium employed is as follows. A solution is prepared containing monopotassium phosphate 0·4 per cent., magnesium sulphate 0·04 per cent., magnesium citrate 0·1 per cent., asparagin 0·6 per cent., and glycerine 2·0 per cent. To 120 cc. of this solution are added 6 gm. of potato meal, and the mixture is left for 2 hours in the steamer. After cooling to 50° C., four whole eggs and 10 cc. of a sterile 2 per cent. solution of Congo Red are added, and the mixture is filtered through gauze. The mixture is then distributed into tubes and sterilized (in the sloping position) in the same way as Loeffler's serum.

The blood-culture is taken as follows: 10 cc. of blood are withdrawn into a tube containing 3 cc. of a 10 per cent. solution of sodium citrate and centrifuged with precautions as regards sterility. The supernatant plasma is removed, the corpuscles are dissolved with sterile acetic acid, and the

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tube is again centrifuged. The deposit is then shaken up with 15 per cent sulphuric acid, for five minutes, sterile distilled water is added and the tube is centrifuged again. After one further washing to remove the excess of sulphuric acid the whole deposit is removed with a sterile pipette, and sown on the medium described above. A preliminary sowing may be made after the treatment with acetic acid.

With this technique, visible colonies often appear after twelve days' incubation. Positive blood cultures have been obtained from 5 of 7 cases of afebrile renal tuberculosis, from cases of glandular tuberculosis, from a small proportion of cases of tuberculosis of the skin, and from every case of severe pulmonary tuberculosis and of miliary tuberculosis which has been examined. In mild cases of pulmonary tuberculosis a positive result has not yet been obtained.

W. W. C. Topley.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 9.

Petroff, S. A. & Steenken, W., Jr. **Biological Studies of the Tubercle Bacillus. I. Instability of the Organism—Microbic Dissociation.** *J. Exper. Med.* 1930, v. 51, 831-45, 9 pls. [10 refs.] [Trudeau Sanatorium, Trudeau, N.Y.]

The authors describe, and figure in a series of 48 photographs, colony-variants which they have obtained from human, bovine and avian strains of the tubercle bacillus, and from the B.C.G. strain. They point out that the term "dissociation," as at present employed, is not adequate to describe the instability which they have observed in their cultures, and that the terms "rough" and "smooth" must not be taken as possessing all the implications attaching to them in connexion with other bacterial groups. In their own description they use the term "rough" as indicating greater resistance to environmental conditions associated with a lower degree of virulence, the term "smooth" as indicating lessened resistance to environmental conditions associated with a higher degree of virulence. In particular circumstances the terms happen to be descriptive of the colonial appearances, for instance in the case of the avian bacillus growing on plain gentian-violet egg medium, or of the bovine bacillus growing on the same medium with the addition of 0·25 per cent. sodium tauro-cholate. Two extreme types of variant have been dissociated from four strains of B.C.G. obtained from different sources. One of these is capable of producing progressive disease, leading to death; the other is slightly virulent, or completely avirulent. [For details of the exact technique employed in these studies, which the authors regard as essential for successful isolation of the variants described, reference must be made to the original paper.]

W. W. C. Topley.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 9.

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OLDENBUSCH, C., FROBISHER, M., JR., & SHRADER, J. H. **Thermal Death Point of Pathogenic Bacteria in Cream and Ice Cream.** *Amer. J. Pub. Health.* 1930, v. 20, 615-18. [2 refs.] [Research Labs., Health Dept., New York].

Considerable study has been devoted to determining the thermal death points of various bacteria in milk. Little has been done to determine whether the time and temperature usually employed in pasteurization (143·5° F. for 30 mins.) is sufficient to kill the non-spore-bearing pathogenic bacteria which may contaminate cream or ice-cream. The authors have determined the time and temperature required to kill *Bact. typhosum*, hæmolytic streptococci, and the tubercle bacillus suspended in cream. Typhoid bacilli were killed at 135° F. in less than 10 mins., at 140° F. in less than 5 mins., and at 142°-155° F. in less than 3 mins. The streptococci did not survive heating at 135° F. for 5 mins., nor at 140°-142° F. for 1 min. Tubercle bacilli were killed, as tested by inoculation into the guinea-pig, in less than 20 mins. at 135° F., in less than 10 mins. at 140° F., in less than 7 mins. at 142°-143·5° F., and in less than 3 mins. at 145° F.

Similar experiments were carried out, using a commercial ice-cream mixture as the suspending medium, and typhoid bacilli, streptococci, tubercle bacilli and diphtheria bacilli as the test organisms. These tests were carried out at temperatures of 145° F. and 150° F. The results did not differ materially from those obtained with cream.

W. W. C. TOPLEY.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 9.

ZELLER, H., WEDEMANN, W., LANGE, L. & GILDEMEISTER, E. **Ueber die sog. niedrige Dauerpasteurisierung der Milch mit besonderer Berücksichtigung der Abtötung von Seuchenerregern. [Low Temperature Pasteurization of Milk with Particular Reference to the Killing of Disease-producing Agents.]** *Arb. a.d. Reichs-Gesundheitsblatt.* 1929, v. 61, 1-72, 5 figs. [165 refs.]

This paper must be regarded as an extremely valuable contribution to the subject with which it deals. The first section is devoted to a résumé of the work on the subject previously carried out in various countries and the next to a description of the different types of apparatus that have been devised to carry out the pasteurization of milk on a commercial scale. There follows an account of the chemical, physical and biological changes produced in milk by low temperature pasteurization. The main changes are a decrease in the degree of acidity, an increase in the time required for spontaneous curdling to occur, and greater ease in separating the cream. Some of the albumin is coagulated and the caseinogen is altered so that it produces a less solid coagulum. No simple method of recognizing with certainty that milk has been treated by low temperature pasteurization was found. A great deal of new work is reported dealing with the effects

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of low temperature pasteurization on the survival of disease-producing agents. The virus of foot-and-mouth disease was invariably killed, even when scabs from infected animals were added to milk ; it was found to be impossible to infect guinea-pigs, calves, or pigs, with injected suspensions of the scabs after they had been heated for 30 minutes at 60-62° C. The *Br. abortus*, *Bact. coli*, various members of the paratyphoid group and *Bact. typhosum* were all completely killed. Streptococci obtained from cases of bovine mastitis were reduced in numbers, but not completely killed.

One third of the paper is devoted to a study of the very important question of the influence of low temperature pasteurization on the destruction of tubercle bacilli. The method adopted in the large number of experiments carried out was to feed calves and young pigs on milk which had been efficiently pasteurized in a recognized type of commercial apparatus, and after killing them to examine them for obvious tuberculous lesions, and in all cases of doubt to inject guinea-pigs with suspensions of any enlarged glands that might be found. Of 32 young pigs fed on untreated tuberculous milk, 29 had obvious tuberculous lesions, and the remaining three were shown to have infected foci by guinea-pig inoculation. Of 30 similar animals fed on pasteurized tuberculous milk, 25 developed no lesions, and no tubercle bacilli could be demonstrated in them by guinea-pig inoculation ; in the remainder tubercle bacilli could be demonstrated only by inoculation of lymph glands into guinea-pigs. In the experiments with calves, 15 out of 16 fed with untreated tuberculous milk developed obvious tuberculous lesions ; in the remaining animal no tubercle bacilli were demonstrated. Out of 22 calves fed with pasteurized tuberculous milk 18 remained completely free from infection. Three of the others developed obvious tuberculous lesions, and in the fourth infection could only be demonstrated by inoculation experiments. The milk used in these experiments was heavily infected with tubercle bacilli ; the conclusion is therefore drawn that even under very unfavourable conditions low temperature pasteurization affords a very great deal of protection against tuberculosis, even though the protection is not absolute. It has been shown that high temperature pasteurization does not completely destroy either tubercle bacilli or streptococci in milk. Seeing, therefore, that low temperature pasteurization possesses many advantages that high temperature pasteurization does not possess, and at the same time possesses no corresponding disadvantages, the former method should be considered the method of choice. The sanctioning of the method by Government or local authorities concerned should nevertheless depend on the scrupulous inspection of the working of types of apparatus that have been proved to be efficient.

S. J. COWELL.

Reprinted from "Bulletin of Hygiene," Vol. 5, No. 9.

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Reviews.

TEN YEARS OF WORLD CO-OPERATION. Allen and Unwin. Cloth bound, 10s.

On Tuesday, October 7, the Secretariat of the League of Nations published under the above title a book of nearly 500 pages dealing with the development of the League, the efforts made and the results achieved in ten years of international co-operation on a scale which now extends to the greater part of inter-State relations.

The publication will fill a gap in documentation on the League to which attention has frequently been called. Hitherto those interested in the work of the League have had access either to the numerous and often highly specialized official publications—which it will still be necessary to consult for exhaustive and scientific work—or to popular pamphlets prepared by the Secretariat on each of the League's spheres of activity. "Ten Years of World Co-operation" will take its place between these two sources of information.

The book is a comprehensive and authoritative statement of the facts; it contains a preface by the Secretary-General, an introduction, fourteen chapters, an alphabetical index, and annexes, including the text of the Covenant and bibliographical notices.

It is a valuable guide and reference for every phase of League work, indispensable to libraries and to all students, professors, publicists, historians and politicians in any way concerned with international affairs.

ROSE AND CARLESS' MANUAL OF SURGERY. Wakeley and Hunter. London: Baillière, Tindall and Cox. 1930. Pp. xi + 1592. Plates 19 coloured, and X-rays Supplement. Figures in text, 664. Price 30s.

The thirteenth edition of this classical textbook marks a definite stepping-stone in the history of surgical literature. Mr. Carless, as he states in the Foreword, has, after thirty-two years, "laid down the editorial pen" and handed over the position of Editor-in-Chief to Mr. C. P. G. Wakeley, of King's College Hospital. Mr. Wakeley and Mr. John B. Hunter are now the Editors.

Considerable alterations are seen in the present volume, which has increased in size both as to the number and also the actual size of the pages. The familiar smooth back and red-edged leaves have now given place to a maroon cloth and gold lettering.

The general scheme of the contents remains the same. The earlier chapters, dealing with bacteriology, immunity, inflammation, etc., have been revised by Dr. Carnegie Dixon. Mr. V. E. Negus has brought up to date the chapters on the surgery of the ear, nose and throat. Mr. Bishop Harman has written the chapter on surgical affection of the eye. Sir Frank Powell Connor has contributed a new chapter on tropical surgery. Mr. Eardley Holland has rewritten the surgery of the female genitalia, and Dr. Hadfield the chapter on anæsthesia.

The Radiographic Supplement, which is entirely new, has been con-

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tributed by Dr. Graham Hodson, and the skiagrams are now produced as "negatives," as the surgeon is more accustomed to study the films and not "positive" reproductions. In fig. 14, metatarsal is an obvious misprint for metacarpal.

The use of radium in the treatment of malignant disease is described in Chapter XI, and also in the diseases of special organs. Other recent advances, such as the injection treatment of varicose veins and hæmorrhoids, the Winnett-Orr treatment of compound fractures, and the tannic acid treatment of burns, are now included.

There are many new illustrations, including five in colour. The appendix on military surgery has been omitted.

The cost of the book remains at the very moderate figure of 30s.

With the definite improvements and additions, this edition will surely retain the high position in the forefront of surgical literature held by its predecessors, and we heartily congratulate the new Editors and wish them every success in the future.

CANCER OF THE LARYNX. By Sir StClair Thomson and Lionel Colledge. Published by Kegan Paul, Trench, Trubner and Co., Ltd. London. 1930. Pp. xii + 244. Price 25s. net. A volume in the Anglo-French Library of Medical and Biological Science.

This is a splendid book. In 237 pages the reader is entertained to a complete and absorbing description of modern thought and practice concerning laryngeal cancer. There are 106 illustrations—many in colour—which make the text very easy to follow, while nine reproductions of portraits of pioneers in the subject, including Billroth, Bottini, Semon, etc., render the historical aspect very interesting.

The descriptions are wonderfully clear and concise, especially those dealing with laryngo-fissure, a subject Sir StClair Thomson has made so peculiarly his own, and those of laryngectomy, pharyngotomy, etc., in which Mr. Lionel Colledge has had such extensive experience. Here is crystallized into an amazingly small compass the life experience of an authority of world-wide reputation on the subject of laryngeal cancer which reads like an engrossing novel. The modern student of laryngology is fortunate in having the subject so concisely and entertainingly presented to him.

INJURIES TO JOINTS. By Sir Robert Jones, K.B.E., C.B., F.R.C.S. London: Humphrey Milford. 1930. Third Edition. Pp. 195. Price 6s.

The necessity for a third edition of this book is proof of its value. It was originally written as a War Manual but is equally useful in civil practice. The book is worthy of more than perusal and should be kept for frequent reference. No military medical officer can fail to derive the greatest assistance from a study of the treatment Sir Robert advises in the multiplicity of injuries so common in our work.

Well printed and illustrated, the book is extremely practical, and no difficulty should be experienced in understanding its details.

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The description of Volkmann's ischæmic contraction has been rewritten in this edition, and this terrible catastrophe should never be seen if the principles in the book are followed.

With regard to fractures, the book teems with "tips" of what to do and how to do it; many of the methods advised are not commonly known and are not to be found in the usual reference books.

It is a most excellent book.

THE HEALTH GAME. By B. E. Washburn, M.A., M.D. London: J. and A. Churchill. 1930. Pp. xi + 202. Price 5s.

In this admirable little volume of 220 pages, the author has dealt with the problem of conserving health and preventing disease in a novel and most attractive manner.

Following the preface, he has a special "Note to Teachers and Health Workers." This is followed by "The Rules of the Health Game."

The book is then subdivided into ten chapters, the first six of which deal with the preventable diseases, Chapter VII with personal hygiene, Chapter VIII with food and diet, Chapter IX with first-aid and family health, and the last chapter with community health.

Each chapter opens with a series of questions bearing on the subject-matter of the chapter. These have the effect of making the reader concentrate on his reading.

The teaching is largely given through the medium of imaginary individuals—children and adults—who describe in a fascinating manner conditions as they exist and the lessons they learn therefrom.

The book is well illustrated with twenty illustrations. The information given throughout is thoroughly up to date, and the book ought to be in the possession of every school teacher and family in Jamaica. It would also well repay teachers, sanitary inspectors, and the laity in any country to study this excellent little treatise. P. H. H.

Notice.

A GUIDE TO THE CARE OF INFANTS.

MESSRS. COW AND GATE LIMITED have issued a third, revised and enlarged edition of their handbook "Motherhood" at the remarkably low price of one shilling. This can be recommended as a useful guide to the young mother on matters connected with the health of infants and young children. The importance of a sufficient supply of vitamins is emphasized and it is claimed that the roller process by which "Cow and Gate" dried milk is prepared and the original source of the milk ensure that this food provides an adequate amount without further addition.

We note that the special packing for the tropics contains a reduced quantity of milk fat. The makers state that this renders the food more suitable for tropical conditions and improves its keeping qualities in hot climates.

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OF THE

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ISSUED MONTHLY

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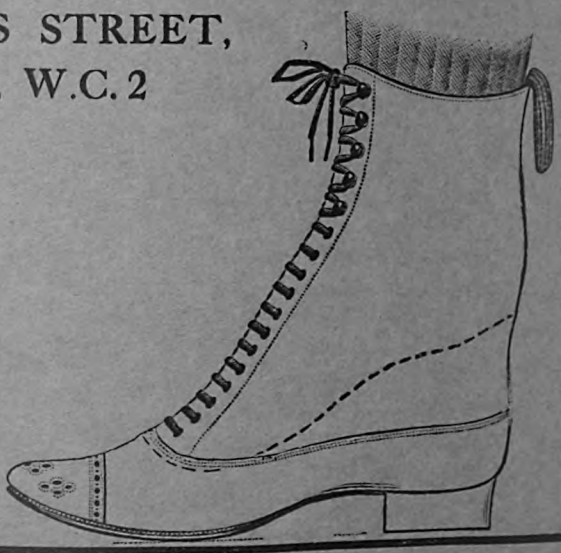
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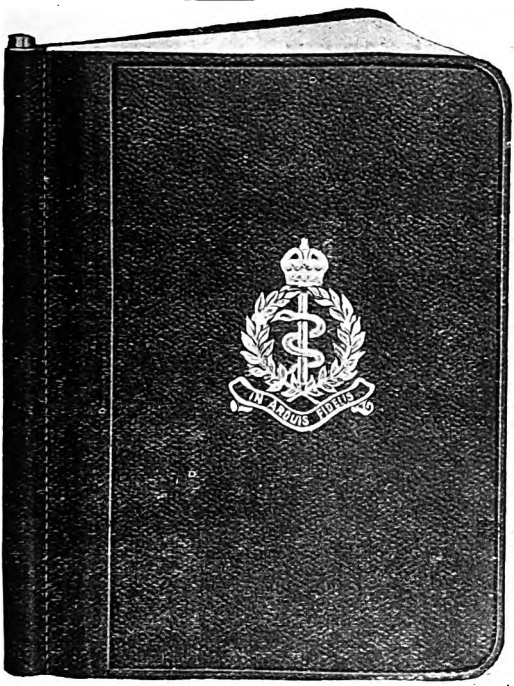
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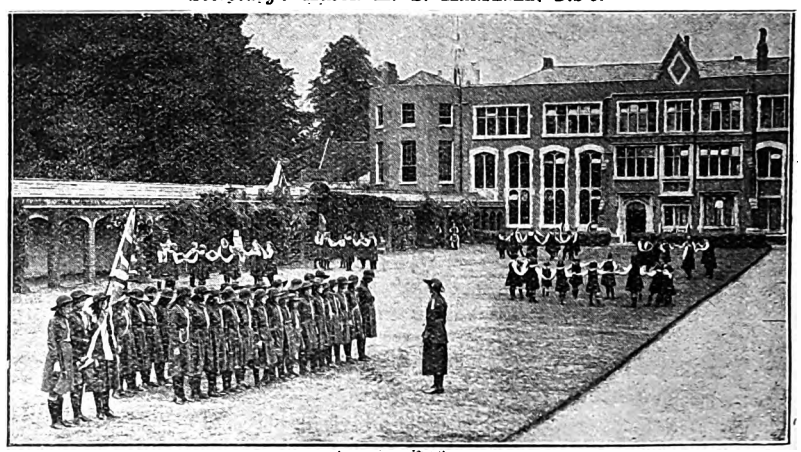
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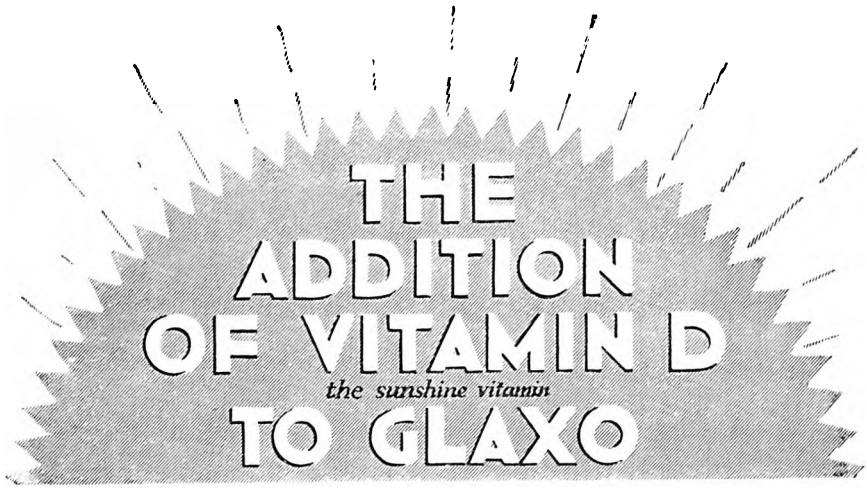
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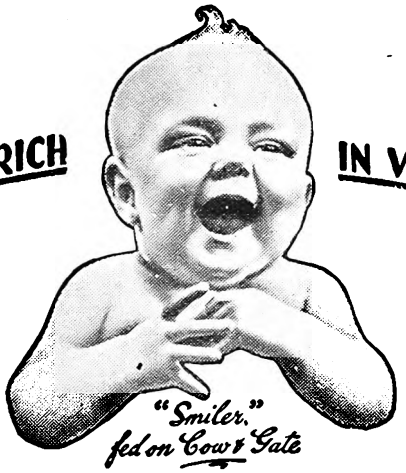
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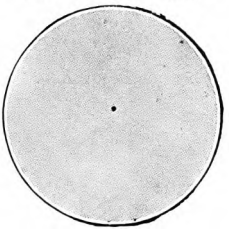
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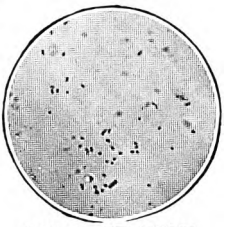
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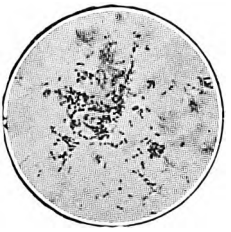


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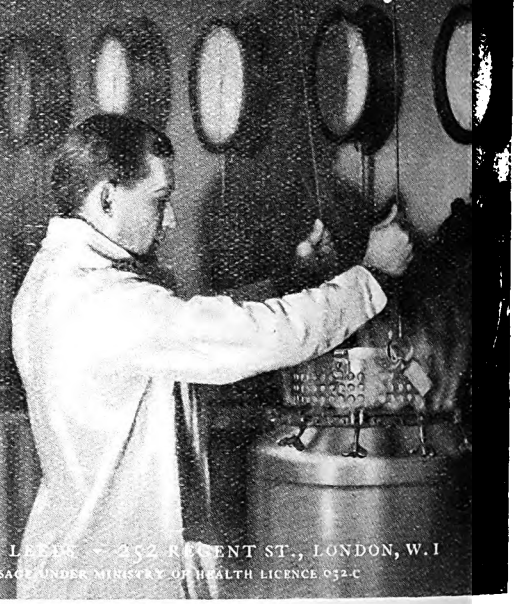
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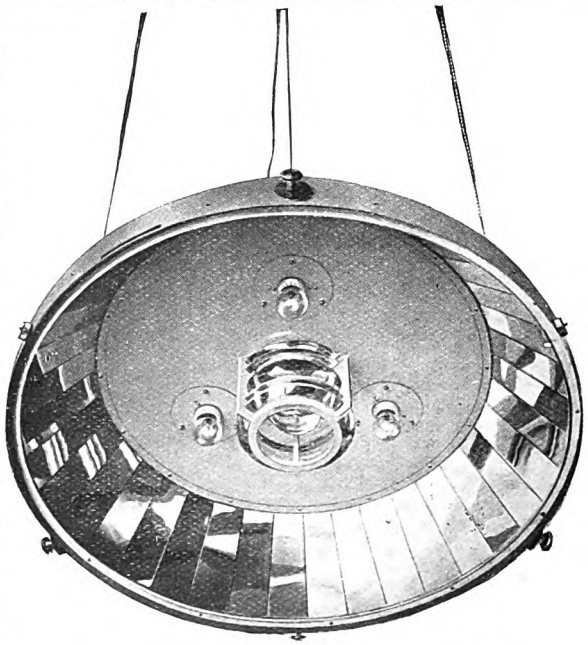
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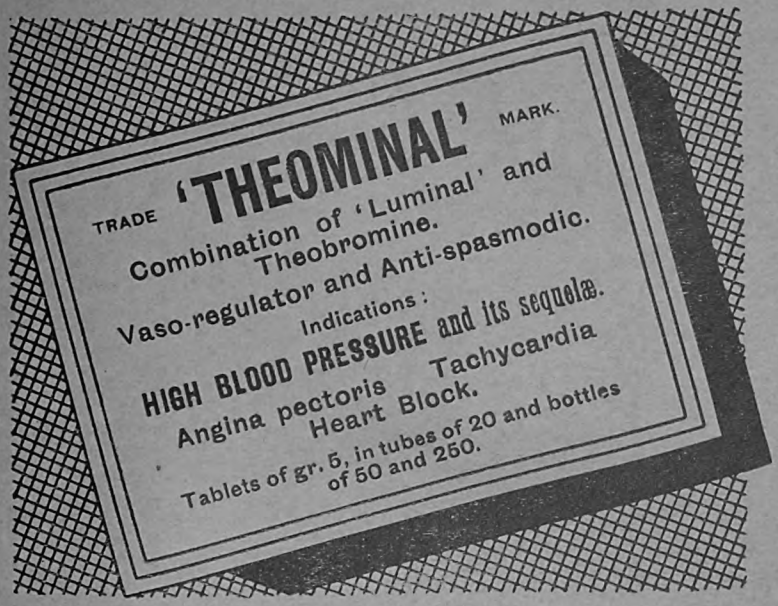
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